TABLE OF CONTENTS

TABLES

FIGURES

APPENDIX

PLATES

LIST OF ACRONYMS

AGI	Amplified Geochemical Imaging
ARAR	Applicable or Relevant and Appropriate Requirements
AST	Aboveground Storage Tank
CFAC	Columbia Falls Aluminum Company, LLC
CFR	Code of Federal Regulation
CLP	Contract Laboratory Program
CoC	Chain of Custody
~~CPOC~~COPC	~~Chemicals~~ Contaminants of Potential Concern
CSM	Conceptual Site Model
DO	Dissolved Oxygen
DQO	Data Quality Objectives
DU	Decision Unit
DUSR	Data Usability Summary Report
EDD	Electronic Data Deliverable
FNU	Formazin Nephelometric Units
FSP	Field Sampling Plan
GC	Gas Chromatography
GIS	Geographic Information System
GPR	Ground Penetrating Radar
HASP	Health and Safety Plan
HCL	Hydrochloric Acid
ISM	Incremental Sampling Methodology
ITRC	Interstate Technology & Regulatory Council
LCS	Laboratory Control Sample
LNAPL	Light Non-Aqueous Phase Liquids
MCL	Maximum Contaminant Levels
MDEQ	Montana Department of Environmental Quality
MDL	Method Detection Limit
MPDES	Montana Pollutant Discharge Elimination System
MS	Matrix Spike
MSD	Matrix Spike Duplicate
MSW	Municipal Solid Waste
NOAA	National Oceanic and Atmospheric Administration
NTU	Nephelometric Turbidity Units
ORP	Oxygen Reduction Potential

LIST OF ACRONYMS (Continued)

PAH	Polyaromatic Hydrocarbon Compounds
PCB	Polychlorinated Biphenyls
PCDDs	Polychlorinated dibenzo-p-dioxins
PCDFs	Polychlorinated dibenzofurans
PID	Photoionization Detector
PQL	Practical Quantitation Limit
PVC	Polyvinyl chloride
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Protection Plan
RI	Remedial Investigation
RL	Reporting Limit
RPD	Relative Percent Difference
SAP	Sampling and Analysis Plan
SCDM	Superfund Chemical Data Matrix
SLERA	Screening Level Ecological Risk Assessment
SOP	Standard Operating Procedure
SPL	Spent Potliner
SVOC	Semivolatile Organic Compounds
TAL	Target Analyte List
TBC	To Be Considered
TCL	Target Compound List
TCLP	Toxicity Characteristic Leaching Procedure
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank
VOC	Volatile Organic Compounds
XRF	X-Ray Fluorescence

1.0 INTRODUCTION

On behalf of Columbia Falls Aluminum Company, LLC (CFAC), Roux Associates, Inc., has prepared this Phase I Site Characterization Sampling and Analysis Plan (Phase 1 SAP) for the Remedial Investigation/Feasibility Study (RI/FS) of the CFAC facility located in Flathead County, Montana (hereinafter, "the Site"). The boundaries of the Site as defined in the Phase 1 SAP are depicted in Plate 1. The SAP consists of two parts: 1) a Field Sampling Plan (FSP) that describes the data gathering and sampling activities and associated fieldwork procedures for the Phase 1 Site Characterization; and 2) a quality assurance project plan (QAPP) that describes the policy, organization, functional activities, and quality assurance (QA) and quality control (QC) protocols necessary to achieve the data quality objectives (DQOs) of the RI/FS Phase 1 Site Characterization Program.

This SAP has been developed in general accordance with the USEPA RI/FS Guidance (USEPA, 1988), USEPA Guidance for Quality Assurance Project Plans (USEPA, 2002a) and the Guidance on Systematic Planning Using the Data Quality Objectives Process (USEPA, 2006). The remainder of the SAP is organized as follows:

<u>PART 1 – Field Sampling Plan (FSP)</u>

- Section 2 – Site Background
- Section 3 – Data Quality Objectives
- Section 4 – Phase 1 Sampling Plan
- Section 5 – Field Sampling Procedures

<u>PART 2 – Quality Assurance Project Plan (QAPP)</u>

- Section 6 – Group A: Project Management
- Section 7 – Group B: Data Generation and Acquisition
- Section 8 – Group C: Assessment and Oversight
- Section 9 – Group D: Data Validation and Usability

2.0 SITE BACKGROUND

This section provides a description of the Site and pertinent background information about the project.

2.1 Site Description

The facility is located at 2000 Aluminum Drive in Columbia Falls, Flathead County, Montana (Figure 1). The Site is accessed by Aluminum Drive via North Fork Road (County Road 486). The Site is approximately 2.0 miles northeast from the center of Columbia Falls and the Site is accessed by Aluminum Drive via North Fork Road (County Road 486). According to the 2013 Census (www.census.gov), the total population of Columbia Falls is 4,796. The nearest residences are located approximately 0.80 miles west of the Site and the nearest groundwater wells used for drinking water are located within 1 mile from the Site. Existing onsite wells are not used for potable water.

The total property owned by CFAC is approximately 3,196 acres (Figure 1). However, the historic footprint of operations and a peripheral area (collectively referred to hereinafter as the "Site"), consists of approximately 1,340 acres bounded by Cedar Creek Reservoir to the north, Teakettle Mountain to the east, Flathead River to the south, and Cedar Creek to the west (Figure 2). The non-industrial areas of the Site have been previously used for recreational purposes such as hunting and fishing, etc. The remainder of the CFAC owned property is located south of Flathead River and was never used for industrial operations.

Buildings and industrial facilities located at the Site include offices, warehouses, laboratories, mechanical shops, paste plant, coal tar pitch tanks, pump houses, casting garage, and the potline facility. The Site also includes seven closed landfills, one active landfill, material loading and unloading areas, two closed leachate ponds, and several wastewater percolation ponds ~~operating under MPDES permits~~. A rectifier yard and switchyard owned by Bonneville Power Administration and a right-of-way for the Burlington Northern Railroad are also within the Site boundaries.

A summary of the physical setting of the Site, including a review of the Site topography, climate, geology, hydrogeology, and groundwater flow is provided in Sections 2.0 and 3.0 of the RI/FS Work Plan.

2.2 Site Operational History

Aluminum was produced at the Site from 1955 to 2009. The facility began with two potlines in 1955 and an annual capacity of 67,500 tons per year (using 120 pots per potline). A third potline was added in 1965, and a fourth and fifth potline were added 1968, increasing total aluminum production capacity at the Site to 180,000 tons per year.

During aluminum production, the Hall-Heroult process and the Vertical Stud Soderburg technology was used to reduce alumina into aluminum. In the Hall-Heroult process, aluminum oxide is dissolved into sodium fluoride (cryolite) bath in a carbon-lined pot heated to 960 degrees Celsius. Electric current runs through a carbon anode made of petroleum coke and pitch, to a carbon cathode (the steel pot, firebrick liner, and a layer of carbon paste), reducing the aluminum ion to aluminum metal. The anode is consumed during the reaction, and molten aluminum forms at the bottom of the pot. The molten aluminum is tapped from the pot and was blended to an alloy (depending on the order). The aluminum is then transferred to the casting garage, and cast into ingots as the finished product for offsite shipment.

A Rod Mill, in the southwest corner of the Main Plant Area, was also operated until the late 1960s. The Rod Mill was used to produce aluminum wire and cable. After its use as a Rod Mill, the building was used as a warehouse. The aluminum production process generated several waste products, most notably spent potliner (SPL). The sodium in the cryolite bath gradually penetrates the carbon paste lining of the pot, causing the carbon to swell and eventually fail. The typical lifespan of the carbon cathode is 5-7 years. To re-use the pot, the carbon lining of the pot is removed and replaced with a new carbon lining. The SPL consists of the thick layer of carbon bonded to an insulating brick layer, containing fluoride, sodium, aluminum, and small amounts of cyanide. The fluoride and sodium in the SPL is from the sodium fluoride (cryolite) bath, and the cyanide forms in the cathode as a side chemical reaction during aluminum production.

The aluminum production process generates air emissions, including particulate fluoride, hydrogen fluoride, and polyaromatic hydrocarbon compounds (PAHs). The main sources of air emissions are typically the Paste Plant and the aluminum reduction facility (USEPA, 1998). Air pollution from the smelting process was controlled using wet scrubbers until 1976, and air pollution from the Paste Plant also used a wet scrubber from 1955 to 1999. Waste water from the wet scrubbers was discharged to the North Percolation Ponds (CFAC, 2003). The wet scrubbers were replaced with dry scrubbers in 1976, and an analysis of the sludge by the Columbia Falls Reduction Plant laboratory staff indicated that the sludge is about 80% calcium fluoride on a dry weight basis, and also contained calcium oxide, magnesium oxide, sodium oxide and iron oxide (Hydrometrics, 1993). The sludge generated from the scrubbers was landfilled on Site.

Raw materials were delivered to the Site predominantly by rail, and include aluminum oxide, petroleum coke, coal tar pitch and fluoride/cryolite. Alumina was delivered to the off-loading buildings, where the alumina was transferred to the silos between the potlines. Petroleum coke and coal tar pitch are delivered to the northeast side of the plant and mixed in the Paste Plant to form briquettes to be used as anodes.

Solid waste generated by the aluminum production process was primarily disposed of in on-site landfills until the mid-1980s, after which SPL was shipped offsite for disposal as hazardous waste. In addition to SPL and wet scrubber sludge, the on-Site landfills were used to dispose of other wastes such as: dross, solvents, potliner refractory wastes (non-hazardous - likely the scrap calcined petroleum coke, ore, cryolite, aluminum fluoride, bath, brick, concrete), scrap metal, wood, used oil and municipal solid waste (MSW). A summary of the years of operation and types of wastes reportedly disposed of at each landfill over time is provided in Section 2.72 of the RI Work Plan.

Liquid waste generated as a result of the aluminum reduction process was discharged to several percolation ponds. The facility discharged to the percolation ponds in accordance with a MPDES permit, first issued in ~~1985~~1994. A summary of the liquid waste disposal areas is provided in Section 2.7.2 of the RI/FS Work Plan.

3.0 DATA QUALITY OBJECTIVES

The DQOs for the RI/FS were developed using the USEPA DQO process (USEPA, 2006), which is designed to clarify the objectives of data collection and maximize efficiency during the data collection process. The DQO process is a multi-step, iterative process that ensures that the type, quantity, and quality of environmental data used in the decision making process are appropriate for its intended application.

The objectives for the RI are:

- Identify and characterize sources of contaminants of potential concern (COPCs);
- Determine the nature and extent of Site-related COPCs in soil, groundwater, surface water, sediment, and sediment porewater;
- Understand the transport and fate of COPCs in environmental media at the Site;
- Identify any complete or potentially complete exposure pathways (considering current and also potential future land use) and evaluate current and future human health and ecological risks posed by the COPCs present at the Site; and
- Support the development and evaluation of remedial alternatives for the Site.

A summary of the step-by-step DQO process followed to develop the Scope of Work for the Phase I Site characterization field activities is provided in Section 6.5. The basis of the sampling design for Phase 1 is described below.

The Phase I Site Characterization program has been designed to identify and/or confirm source areas and associated COPCs, as well as provide a broad characterization of the hydrogeologic conditions and the nature and extent of contamination across the Site. Based on the current understanding of the Site conditions and CSM, the following objectives were established for Phase I Site Characterization Program:

- Evaluate current conditions at all identified RI areas and Site features to determine which RI areas and Site features require further investigation and/or quantitative evaluation in the baseline risk assessment. The RI Areas that will be investigated during Phase I include:
  - Landfills and Leachate Ponds;
  - Percolation Ponds;
  - The Main Plant Area;

- Operational Area Soils;
- Site-wide Groundwater; and
- Surface Water Features.

- Refine the list of COPCs that require further investigation at various RI areas and Site features so lists of laboratory analyses can be reduced during subsequent phases of investigation;
- Refine the understanding of groundwater flow beneath the Site, particularly in the vicinity of potential receptors;
- Develop a more detailed understanding of bedrock topography and the depths, thicknesses and extents of the various hydrogeologic units, both of which may influence groundwater flow and the distribution of COPCs in the subsurface;
- Begin to evaluate seasonal influences on groundwater/surface water interactions and contaminant concentrations in groundwater and surface water;
- Develop data to support the preparation of the baseline risk assessment work plan; and
- Develop data to support identification and screening of remedial technologies as part of the FS.

The results of the Phase 1 Site Characterization will be used to update the preliminary Conceptual Site Model provided in Section 3.0 of the RI/FS Work Plan and prepare the Baseline Risk Assessment Work Plan. This process will enable identification of any outstanding data that still needs to be collected in order to complete the RI Site characterization and conduct a risk assessment. The identified data needs and the scope of work to collect the data will be presented in a Phase II Site Characterization SAP. The Phase II Site Characterization SAP will include updated data quality objectives to evaluate the data needs required to complete the RI and risk assessment.

4.0 PHASE I SAMPLING PLAN

The Phase I Site Characterization Scope of Work was developed based on the data quality objectives and the data requirements identified during preparation of the RI/FS Work Plan. The description of the basis for the sampling plan design is provided below, followed by a description of the sampling plan for the field activities planned for Phase I.

4.1 Sampling Plan Design

As described in Section 4.2, several different types of data gathering and sampling activities are required to achieve the project objectives. The locations and numbers of sampling points associated with each type of activity were typically selected based upon judgmental sample design. As described in USEPA guidance on sampling design (USEPA, 2002b), judgmental sampling design is appropriate when there is reliable historical and physical knowledge about the feature or condition under investigation; or, when the objective of the investigation is to screen an area(s) for the presence or absence of contamination at levels of concern, such as risk-based screening levels. Both of these conditions are generally applicable for the current phase of work. Specifically, there is knowledge about most Site features (i.e., locations and dimensions, historical use) and the goals of the Phase 1 Site Characterization program include use of risk-based screening levels to identify areas for further investigation and/or inclusion in subsequent risk assessment.

Although the sampling plan for known or suspected source areas is judgmental in design, it will be conducted using a systematic phased approach. Field reconnaissance will be conducted first, followed by geophysical surveys and soil gas surveys. The findings from these activities will be evaluated and used to refine source area sample locations such that they are biased towards areas where COPCs are considered more likely to be present.

Judgmental sampling design has also been used to develop the scope of work for investigation of hydrogeologic and groundwater quality conditions at the Site. Per USEPA guidance, judgmental design is appropriate considering the scale of the Site and lack of adequate probabilistic investigation methods.

A stratified random sampling approach will be utilized as per USEPA guidance on sampling design (USEPA, 2002b) and the Interstate Technology & Regulatory Council (ITRC) Incremental Sampling Methodology (ITRC, 2012) to characterize soil quality conditions in the surface soil and shallow subsurface soil (0 to 0.5 ft-bls and 0.5 to 2.0 ft-bls, respectively) within large areas of the Site where there are no specific source areas identified, but aerial photographs or Site knowledge suggests evidence of historical operations activity. As described in Section 4.6.2, an incremental sampling methodology will be utilized in these areas to produce a better estimate of average soil conditions within individual grid cells uniformly distributed across the large area.

As discussed in Section 6.1 and Section 6.2 of the RI/FS Work Plan, COPCs will be evaluated during the Phase I Site Characterization based upon comparison of analytical results to human health screening levels and ecological screening levels drawn from the following sources as indicated for each media type:

Human Health Screening Levels

Soil

- EPA Risk-Based Screening Tables: residential soil RSL, Risk-based soil screening level (SSL) for the protection of groundwater

- Montana Tier 1 Risk-based Corrective Action Guidance for Petroleum Releases (September 2009) for petroleum compounds

Surface Water and Groundwater

- EPA Risk-Based Screening Tables: tapwater RSL, drinking water maximum contaminant level (MCL)

- Montana DEQ Circular DEQ-7: http://www.deq.mt.gov/wqinfo/circulars.mcpx

Sediment

- EPA Risk-Based Screening Tables: residential soil RSL

Ecological Screening Levels

Soil

- EPA Ecological Soil Screening Levels: http://www.epa.gov/ecotox/ecossl/

- Los Alamos National Laboratory (LANL) ECORISK Database, Los Alamos, New Mexico. http://www.lanl.gov/community-environment/environmental-stewardship/protection/eco-risk-assessment.php

- Sample, BE, DM Opresko, GW Suter II. 1996. *Toxicological Benchmarks for Wildlife: 1996 Revision.* Oak Ridge National Laboratory. Document ES/ER/TM-86/R3. June 1996. http://www.esd.ornl.gov/programs/ecorisk/documents/tm86r3.pdf

- *Region 5 RCRA Ecological Screening Levels*, August 22. http://www.epa.gov/Region5/waste/cars/esl.htm

Surface Water and Groundwater

- EPA National Recommended Water Quality Criteria: http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm

- Suter II, GW and CL Tsao. 1996. *Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota: 1996 Revision*. Oak Ridge National Laboratory. Document ES/ER/TM-96/R2. June 1996. http://www.esd.ornl.gov/programs/ecorisk/documents/tm96r2.pdf

- Canadian Council of Ministers of the Environment (CCME). *Canadian Water Quality Guidelines, Summary Table,* http://st-ts.ccme.ca/

- Montana Department of Environmental Quality (DEQ) Circular DEQ-7: http://www.deq.mt.gov/wqinfo/circulars.mcpx

Sediment

- MacDonald, D.D., C.G. Ingersoll, and T.A. Berger. 2000. Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems. *Archives of Environmental Contamination and Toxicology* 39:20-31.

- Ingersoll, C.G., P.S. Haverland, E.L. Brunson, T.J. Canfield, F.J. Dwyer, C.E. Henke, N.E. Kemble, D.R. Mount, and R.G. Fox. 1996. Calculation and evaluation of sediment effect concentrations for the amphipod *Hyalella azteca* and the midge *Chironomus riparius; and*

- *Region 5 RCRA Ecological Screening Levels*, August 22. http://www.epa.gov/Region5/waste/cars/esl.htm

- USEPA Region 3 Biological Technical Assistance Group Freshwater Sediment Screening Benchmarks (August 2006)

Concentrations of naturally occurring substances will also be compared to concentrations measured at background and upgradient sampling locations to evaluate whether the measured concentrations of those substances are related to the Site. Human health risk-based screening levels (RSLs) provided in the EPA Risk-Based Screening Tables will be based on target cancer risk of 1E-06 and target hazard quotient of 0.1. For the purposes of identifying COPCs, the lowest value, across all sources, should be selected as the screening level.

4.2 Phase 1 Activities

As discussed in Section 4.2 of the RI/FS Work Plan and summarized in Section 3.0 above, the RI will be conducted as an iterative approach and will include at least two phases of investigation work. The following types of data gathering and sampling activities will be conducted as part of the Phase 1 Site Characterization program:

- Site Reconnaissance
- Geophysical Survey
- VOC Focused Passive Soil Gas Sampling and Landfill Gas Investigation
- Soil Boring and Soil Sampling
- Monitoring Well Installation and Gauging
- Groundwater Sampling
- Surface Water Sampling
- Sediment Sampling
- Drywell Sampling
- Waste Characterization Sampling, if needed

Items that are currently planned to be conducted during subsequent phases of investigation include, but are not limited to:

- Topographic survey of the landfills
- Investigation of the physical landfill caps, where present
- Evaluation of the hydraulic properties of the various hydrogeologic units at the Site via slug testing and/or aquifer testing

- Sediment Porewater Sampling

The remainder of this Section describes the locations and sampling rationale for the Phase I field activities. A Site-wide summary of the proposed investigation locations are shown on Plate 1. Additionally, the proposed investigation locations are shown for specific areas of the Site in Figures 3 through 8.

Table 1 provides a summary of the samples defined for collection during the Phase I Site Characterization. The information in Table 1 includes: latitude and longitude (determined from GIS), the sample location type, sample media type, the closest Site feature to the sample, the rationale for each sample, and the proposed analyses for each sample. For the sample rationale, samples labeled as "within feature" were generally selected to characterize quality beneath the feature and samples labeled as "boundary of feature" were generally selected to delineate quality immediately outside the feature and determine aerial extent of potential COPCs. Additionally, samples proposed near the Flathead River and residential areas are generally positioned to evaluate conditions downgradient of the Site features and near potential receptors. As indicated in the RI/FS Work Plan, it is anticipated the number of samples and locations of samples will be modified based upon the results pre-intrusive field activities. The scope of such modifications and the associated rationale will be detailed in a SAP addendum prior to implementation.

4.3 Site Reconnaissance

A detailed Site reconnaissance will be performed prior to conducting other field investigation activities. The objectives of the Site reconnaissance are to:

- Field verify existing base maps and aerial photographs (check for accuracy of map coordinates versus GPS and survey data);

- Refine soil boring locations that are proposed to be biased towards areas of known or suspected areas of contamination;

- Identify any additional areas / site features where COPCs potentially were released, and where samples should be collected, based upon visual indications of waste materials, soil piles, staining, stressed vegetation, etc.;

- Develop a further understanding of drainage / overland flow and document any erosional features at the Site that may be contaminant migration pathways;

- Identify habitat areas for further evaluation in the SLERA; and
- Confirm accessibility and determine equipment requirements for access to proposed sampling locations.

The Site reconnaissance will be conducted using a systematic approach. As a first step of the ground-level Site reconnaissance, a licensed land surveyor will establish coordinates of several fixed locations at the Site. The accuracy of the existing geo-referenced maps and aerial photographs will be evaluated by comparing coordinates obtained from GIS with the coordinates established by the surveyor. Likewise, the accuracy of hand-held GPS will be evaluated by comparing GPS coordinates with coordinates established by the surveyor. Any discrepancies in coordinates between the various locating methods will be resolved prior to proceeding with additional elements of the Site reconnaissance task. The subsequent ground level field reconnaissance will consist of qualified scientists or engineers visually inspecting and photo-documenting the conditions of the Site features within the various RI Areas.

Key selected subcontractors (i.e., surveyor, geophysical survey, drilling, etc.) will take part in selected aspects of the field reconnaissance to confirm equipment requirements for accessibility and to confirm the technical approach for their respective assignments.

Calbag Resources, LLC (Calbag) was recently retained by CFAC to complete the decommissioning and removal of certain structures, machinery, equipment, and waste materials at the Site. Prior to beginning RI/FS field activities, planning meeting(s) will be conducted to ensure that the Calbag activities and the Phase 1 Site Characterization program are properly coordinated. The purpose of this planning will be to determine how best to sequence and/or adjust RI/FS work activities in the vicinity of the ongoing Site decommissioning activities, to ensure that all of the RI/FS objectives are met while also ensuring worker health and safety and allowing for continued progress of the Site decommissioning project.

The Site reconnaissance will also include an inspection of existing Site monitoring wells to evaluate the integrity and accessibility for use during the investigation. Any deficiencies or obstructions will be noted for future consideration when planning sampling activities.

The Site reconnaissance will also include a habitat and biological survey. The Survey will include both terrestrial and aquatic habitats and will allow for a detailed characterization of the environmental setting as it pertains to the SLERA. The survey will be conducted by a team of two biologists over a period of one to two weeks. It will include walking the entire Site, including visual inspection and photo-documentation of all distinct habitat areas and flora and fauna observed within these areas and recording of field notes regarding these observations.

4.4 Geophysical Survey

A geophysical survey will be completed as a screening tool that will allow for initial assessment of subsurface characteristics prior to drilling activities. The geophysical survey will employ electrical resistivity technology with the goal of providing a preliminary understanding of approximate depth to bedrock, approximate depth to groundwater, approximate depth of Site features, potential changes in subsurface hydrogeological conditions and potentially other subsurface anomalies that may contribute to the delineation of source areas.

The initial geophysical survey will be implemented in the vicinity of the West Landfill and the Wet Scrubber Sludge Pond. These two source areas have been previously attributed to the COPCs present at the Site. Additionally, geophysics will be applied to a transect perpendicular to Teakettle mountain with the goal of understanding how bedrock dips away from Teakettle Mountain and to evaluate any other potential hydrogeologic aspects of the subsurface. The actual methodology and scope of the various elements of the geophysical survey will be finalized following the Site reconnaissance meetings with the selected geophysical subcontractor, based upon an evaluation of the potential benefits towards achieving the RI objectives. A summary of the proposed geophysical Scope of Work will be submitted to the USEPA for review prior to conducting the field work. Additionally, the results of the initial geophysical surveys will be evaluated to determine if the technology is applicable and beneficial within the Site and if additional surveys should be conducted.

It is anticipated that ground penetrating radar (GPR) can provide useful information to confirm the horizontal extent of landfills and associated landfill caps, as well as information on cap thickness. Therefore, GPR will be utilized as part of the landfill cap investigation. In addition, GPR will be utilized when appropriate for mark out of subsurface utilities or obstructions in the area of proposed drilling locations.

The results of the geophysical survey will be evaluated prior to conducting intrusive activities and results will be considered when finalizing drilling locations and depths. Any changes to the FSP as a result of the geophysical surveying activities will be described in a Phase 1 SAP Addendum and summarized in the summary report.

4.5 Soil Gas Investigation

The soil gas investigation will consist of two elements: 1) field screening of landfill soil gas; and 2) a passive soil gas investigation at the former hazardous waste drum storage area and the former vehicle fueling area. A description of the work associated with each element is described below.

Field screening of soil gas will be conducted at landfills to evaluate the potential for methane and VOCs. The screening will be conducted under falling barometric pressure conditions (minimum 12 hours) in order to minimize the potential for false negative results. Prior to the sampling, the barometric pressure will be confirmed using data from the weather station located at Kalispell Glacier Park International Airport, as is further described in Section 7.9.

At each location, a soil gas probe constructed of a 0.5 inch diameter stainless steel pipe with a welded and slotted tip on the end will be pushed into the subsurface to a depth of approximately ~~three~~ five feet. After advancing the probe to the final depth, the annular space around the probe will be sealed at the surface with modeling clay or equivalent to minimize potential short-circuiting of ambient air during sampling. A short length of Teflon tubing will be attached to the soil gas probe and a vacuum pump, and then the probe will be purged for five minutes to allow the inflow of vapors. The monitoring point will be tested using a tracer gas (helium), prior to sample collection, to verify that ambient air is not diluting the soil vapor during screening. A GEM 2000+ Landfill Meter will then be attached to the Teflon tubing and readings recorded for methane, carbon monoxide, hydrogen sulfide, oxygen and barometric pressure. A PID will then be attached to screen for VOCs. Once the readings are completed, the soil gas probe will be extracted from the ground and the hole will be sealed.

A passive soil gas investigation will be conducted at the hazardous waste drum storage area and the former vehicle fueling area. The proposed sample locations are shown in Figures 3 through 8. The objective of the passive soil gas investigation is to identify potential VOC hot spots (if any) so that subsequent intrusive sampling can be focused in these areas to determine if VOCs are a COPC.

The passive soil gas investigation will be conducted using Amplified Geochemical Imaging, LLC (AGI) passive sampling devices (AGI, 2015). The AGI passive sampler is a proprietary, passive, sorbent-based sampler which collects volatile and semivolatile compounds present in soil gas. The AGI passive samplers will be installed within a 1/2 to 1-inch (2.5cm) diameter hole and to a depth of approximately ~~three feet (1 meter)~~five feet below grade; therefore resulting in minimal Site disruption and allowing for a screening of Site features. AGI recommends that for site assessment applications where the primary objective is identification of potential source areas and extent of contamination, the suggested exposure time for soil gas sampling is 7 to 10 days (AGI, 2015).

Following collection, the AGI passive samplers will be shipped under chain of custody to AGI for analysis of VOCs according to a modified USEPA 8260 analytical method.

The passive sampling is meant to provide an initial screening of vapor conditions. Subsequent soil borings will be biased towards the locations that exhibited the highest VOC concentrations, if any. If the passive soil gas investigation results suggest that a source area may exist that extends beyond the investigated area, additional vapor sampling and intrusive activities would be considered to further evaluate the source area conditions.

4.6 Soil Borings and Soil Sampling

This section describes the Phase I soil boring and soil sampling program. The Phase I activities were designed to collect additional geologic data, characterize and delineate potential source areas, and assess soil quality conditions across the Site. The remainder of this section describes the sampling location and procedure rationale.

4.6.1 Source Area Soil Investigation

Soil borings and soil sampling will be conducted in the vicinity of the RI Areas which have been identified as potential source areas in the preliminary CSM. The proposed Phase I source area investigation locations are shown in Figures 3 through 8 and are summarized on Table 1. Proposed Phase I locations around these areas were selected based on a judgmental sampling design (USEPA, 2006) that targets the potential source areas. The number of proposed borings and spacing of proposed borings in Phase I were selected with the goal of providing initial characterization of the nature and extent of contamination associated with individual features.

The proposed locations are typically within the boundaries of the Site feature being investigated in an effort to characterize the soil conditions immediately beneath the feature. In addition, there are proposed borings around the perimeter of most features to assess for impacts to the adjacent areas. For features with engineering controls already in place (e.g., landfill caps), proposed boring locations were placed adjacent to and downgradient of the feature in an effort not to disturb the existing controls. The proposed locations are dependent on Site conditions and may potentially be modified in the field by the RI field manager. As previously discussed, the findings from pre-intrusive investigation activities will be evaluated and used to refine source area sample locations such that they are biased towards areas where COPCs are considered more likely to be present.

Soil borings will be completed utilizing either sonic-rotary drilling or direct-push (e.g., Geoprobe) techniques. Use of the Geoprobe will be limited to borings that are not proposed for completion as monitoring wells, as the depth of these borings will typically be 12 ft. Sonic-rotary drilling methods will be used at all locations where wells are to be installed and at those locations where subsurface conditions prevent the Geoprobe from achieving desired sampling depths.

An experienced drilling subcontractor will be selected prior to mobilization for field activities. All drilling activities will be overseen by the RI Manager and onsite engineers/scientists with experience in oversight of drilling programs.

Prior to drilling, Site plans and drawings will be evaluated and facility personnel consulted to identify whether subsurface utilities or obstructions may be present in the vicinity of the drilling locations. With areas of the Site where subsurface borings or utilities may be present, the drilling locations will be pre-cleared using non-mechanical methods (e.g., hand clearing, air knife, etc.) to a minimum of five ft-bls.

At each proposed location, continuous core samples will typically be collected from land surface to the bottom of the borehole in an effort to obtain lithologic and soil screening data. All of the soil samples will be described in accordance with the Unified Soil Classification System. The core samples will be examined for evidence of potential impacts (i.e., staining, odor) and screened for the potential presence of VOCs using a PID.

The final depth of each soil boring will vary depending on the purpose and location of the boring. It is anticipated that all soil borings will be completed to a minimum depth of 12 ft-bls.

At soil borings locations where both water table and deeper monitoring wells are to be installed, the soil boring for the deeper well will be drilled first. The deeper well will serve as the location of collection of samples for lithologic characterization and analytical laboratory testing.

Three discrete soil samples will typically be collected for laboratory analyses from each soil boring within unpaved areas: a discrete surface soil sample will be collected from the top six inches of soil; a discrete shallow soil sample from the interval of 0.5 to 2 ft-bls; and a discrete deeper sample from a depth of 10 to 12 ft-bls. In paved areas, the surficial sample will be omitted (due to pavement) and shallow sample will be collected from the 2-ft depth interval immediately beneath the pavement materials and deeper sample will be collected from 10 to 12 ft-bls. If contamination is evident in the 10 to 12-foot soil sample interval, drilling and sampling will proceed until contamination is no longer evident in the soil samples, until groundwater is encountered, or the limit of the equipment has been reached. Additional opportunistic soil samples may be collected and sent for laboratory analyses during soil boring activities based on visual observations and/or soil screening results encountered during drilling activities. Opportunistic samples may be collected if contaminants are evident at different depths, including deeper or shallower than 12 ft-bls, subsurface conditions indicate the presence of preferential pathways, or subsurface conditions prevent sampling at the pre-determined depths described above.

Soil samples will be analyzed for the following parameters:

- Target Compound List (TCL) VOCs (excluding surface soil samples) via USEPA Method 8260;
- TCL SVOCs via USEPA Method 8270;
- TAL Metals via USEPA Method 6010;
- TCL PCBs via USEPA Method 8082;
- TCL Pesticides (surface samples only) via USEPA Method 8081;
- Total Cyanide via Method 9012; and
- Fluoride via USEPA method 300.

A soil sample will also be collected from the five to ten feet below the water table at each deep monitoring well location and analyzed for:

- Total Cyanide via USEPA Method 9012; and
- Fluoride via USEPA method 300.

In addition to the sampling listed above, 20% of the soil samples collected from the surface interval (0 – 0.5 ft-bls) will be laboratory analyzed for lead in both sieved (250 microns/No. 60 sieve) and bulk form. The samples selected for both analyses will account for different sources, lithology, or other characteristics that could influence the ratio between sieved and unsieved sample concentrations. Once the two sets of data are available, a ratio of sieved analysis to bulk analysis can be calculated for each sample, and then a 95% upper confidence level (UCL) on the mean of all the ratios can be calculated. The UCL of the ratios may then be used as a factor that can be applied to historic, current, and future bulk samples to estimate lead concentrations.

In addition to the sampling parameters listed above, total organic carbon will be analyzed at each discrete soil ~~interval sampled~~sample within the deep monitoring well locations to support the preparation of the risk assessment and perform fate and transport evaluation. Additionally, a number of discrete source area surface and shallow soil samples will be selected for grain size, bulk density and moisture content analysis for use in fate and transport evaluation as per the MDEQ guidance document titled "Technical Guidance General Field Data Needs for Fate and Transport Modeling" (MDEQ, 2008).

The soil samples collected within the Rectifier Yards will be analyzed for polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs) via USEPA Method 8290. As described in Sections 2.8.5 and 2.8.8. of the RI/FS Work Plan, historical fires and PCB remedial actions have been documented within the Rectifier Yards. PCDDs and PCDFs are by-products that occur when PCB fluid is partially burned.

The specific soil sampling depths and sampling analyses described above will aid in determining the nature and extent of contamination within the Site. The surface soil samples collected from land surface to a depth of six inches will be utilized to determine if contaminants are present at the surface and to evaluate the ingestion, inhalation, and dermal contact exposure routes for Site visitors / trespassers as well as for Site workers performing routine, non-intrusive work activities. Subsurface soil samples collected from 0.5 to 2 ft and from 10 to 12 ft will allow for an understanding of vertical distribution of COPCs and will be utilized to evaluate the presence of COPCs at depths where exposure would occur for Site workers who perform intrusive work activities, such as excavation. Soil samples collected from beneath the water table will provide further vertical delineation of potential COPCs in soil that could potentially be acting as a source of groundwater contamination.

Select soil borings are proposed to be completed as monitoring wells as described in Section 4.5. At deep ~~boring~~ monitoring well locations where potential confining units beneath the water table are encountered during the drilling of soil borings (as evidenced by lithology observed in the continuous core samples), ~~shallow contamination is evident based on field observations,~~ double-cased sonic ~~well~~ drilling ~~and/or other sonic drilling~~ procedures will be used to hydraulically isolate monitoring wells screened with the deeper glacial aquifer(s) from the overlying groundwater system; thereby minimizing any potential for cross contamination. Double casing will be completed utilizing the following steps: 1) Advancing the inner (smaller diameter) sonic casing ahead of the outer casing to characterize lithology. When a confining layer is encountered, the initial continuous coring within the inner casing establishes the depth of this layer 2) Advancing the outer sonic casing into the confining layer, sealing off the upper aquifer 3) Continuing the advancement of the inner sonic casing to the desired depth where a well may be installed; and 4) After the well is set, the process is reversed by filling the annular space with grout and vibrating and extracting both the inner and outer casing.

Soil borings not completed as monitoring wells will be ~~backfilled with a combination of drill cuttings and clean sand~~abandoned using grout or bentonite chips, with the top three feet of each boring backfilled with soil cuttings. If visual impacts are observed during field screening of soils, the cuttings will be drummed for disposal and only clean material will be used for backfill.

4.6.2 Operational Area Soil Investigation

A soil sampling program will be conducted in areas of the Site not currently identified as potential source areas in the preliminary CSM, but where historical operations may have been conducted based on review of aerial photographs and understanding of Site operations. As part of the operational area soil investigation, surface and shallow subsurface soil samples will be collected to assess soil quality conditions, generate data for use in risk assessment, and to screen for the presence of any additional potential source areas that have not been previously identified in the CSM (if any).

The operational area soil investigation will be implemented using an incremental soil sampling method in general accordance with the USEPA guidance for sampling design (USEPA, 2002b) and the Interstate Technology & Regulatory Council (ITRC) Incremental Sampling Methodology (ITRC, 2012). The incremental sampling methodology (ISM) provides representative samples of specific soil volumes defined as decision units (DUs) by collecting numerous increments of soil (typically 30 or more increments) that are combined, processed, and subsampled according to specific protocols. Evaluation of study results has shown that ISM for soil provides a better estimate of the average (mean) concentration within "decision units" (i.e., individual grid cells of specified size), and within the overall area of investigation, than can be obtained from a conventional discrete sampling approach. Decision units that exhibit COPCs at concentrations exceeding ARARs or risk-based criteria may require a more focused investigation during subsequent phases of the RI.

The Operational Soil Area will have two different types of decision units. Given the large operational area that is to be investigated, a decision unit (i.e., grid cell) size of approximately one acre was selected for establishing the sampling grid. As shown in Figure ~~10~~9, the sampling grid consists of 43 decision units. The shape / size of decision units is modified as required in the vicinity of Site features that are part of the source area investigation. The entire Operation Soil Area can also be treated as a single DU, with 43 individual sampling units from which incremental soil samples will be collected. This approach is beneficial because there is no specific source area that has been defined within the Operational Soil Area. This approach will allow for calculation of the mean soil concentration and 95% upper confidence limit (UCL) of the mean for all analytes across the area based upon 43 ISM sample locations. These data can be used in comparison to background concentrations, as well as to compare maximum concentrations detected in entire dataset to conservative screening criteria.

The sampling will be conducted at the frequency of one incremental surface soil sample (0 to 6-inches bls) and one incremental shallow soil sample (0.5 to 2 ft-bls) per one acre DU. Each incremental soil will consist of up to 32 discrete grab samples that are evenly distributed within four quadrants of each DU (i.e., 8 samples per quadrant). Within each quadrant, the 8 locations will be randomly distributed. The coordinates of the random locations will be established using GIS and a random number generator, and field personnel will utilize a hand-held GPS (with sub-meter accuracy) to navigate to each location for sample collection. The ISM procedure is further described in the Roux SOP 5.12 provided in Appendix A.

Soil samples collected using ISM will be analyzed for the same analyses described in Section 4.46.1, including 20% of the surface samples sieved and analyzed for lead. In addition to the ISM soil sampling described above, approximately 16 soil borings will be completed within the operational soil investigation areas. Soil borings will be completed utilizing the same methods as described in Section 4.4.1. Soil samples collected within the operational areas will be analyzed for the same analyses described in Section 4.4.1.

4.6.3 Background Area Soil Investigation

A soil sampling program will be conducted in background areas of the Site not currently identified as potential source areas in the preliminary CSM. The Background Area was generally defined in the western portion of the Site where aerial photographs show unforested areas and industrial operations were not known to take place. As part of the Background Area soil investigation, soil samples will be collected to assess background soil quality conditions and ~~,~~ generate data for use in risk assessment~~, and to screen for the presence of any additional potential source areas that have not been previously identified in the CSM (if any).~~.

Borings proposed within the Background Area are shown on Figure 10. Soil sampling from the borings within the Background Area will be conducted at the same frequency of the source area borings including one surface soil sample (0 to 6-inches bls), one shallow soil sample (0.5 to 2 ft-bls), and one deeper sample from 10-12 ft-bls. Soil samples collected within the Background Area will be analyzed for the same analyses described in Section 4.4.1.

If data collected from the background locations suggest additional source areas of COPCs are present, additional background locations will be selected and sampled in consultation with the USEPA.

4.7 Monitoring Well Installation.

Selected soil borings are proposed to be completed as monitoring wells. The new monitoring wells will be used to supplement the existing monitoring well network at the Site. The proposed locations were selected to provide further evaluation of groundwater quality in potential source areas and in areas that have not previously been monitored while also helping to refine the understanding of Site groundwater flow. The proposed monitoring wells to be installed during Phase I are shown on Figures 3 through 8 and are summarized on Table 1. The proposed locations may be modified based upon the results of the geophysical survey activities as well as the findings from the initial phases of the drilling program.

The majority of the proposed Phase I monitoring wells will be installed immediately below the groundwater table. Screen zones in the water table wells will consist of 10 feet of screen. If field observations suggest the well should be installed to bridge the water table due to the potential presence of light non-aqueous phase liquids (LNAPL), then the well will be installed with 15 feet of screen, including 5 feet above and 10 feet below the water table.

In addition to the water table wells, deep monitoring wells are proposed to evaluate the vertical extent of COPCs in groundwater and to evaluate groundwater flow within deeper hydrogeologic units. Double-cased well drilling and/or other sonic drilling procedures will be used to hydraulically isolate monitoring wells screened with the deeper glacial aquifer(s) from the overlying groundwater system; thereby minimizing any potential for cross contamination. Procedures for installation of double-cased wells are provided in SOP 10.3 discussed in Section 5.1. Additional details regarding well construction will be included in the SAP Addendum.

The deep borings will be advanced until one of the three following criteria are met 1) the top of bedrock is encountered 2) a maximum depth of 300 feet below land surface is reached without encountering bedrock or 3) a shallower depth, at the discretion of the field geologist in consultation with the management team, if a deep hydrogeologic unit is encountered beneath a significant sequence of low permeability material. While drilling deep monitoring wells, undisturbed core samples will be collected for geotechnical analysis within the major water bearing units and low permeability units including grain size, bulk density, and hydraulic conductivity. The screened intervals of the deep wells will be determined by the RI field manager and the on-Site geologist/scientist/engineer performing oversight of the drilling activities based on results of geophysical surveying and field observations made during drilling. Monitoring wells will be constructed of 2-inch diameter Schedule 40 polyvinyl chloride (PVC) casing and 2-inch diameter, 20-slot (0.020 inches) PVC screen flush-threaded onto the PVC casing. Surface completion of each well will consist of a protective stick-up enclosure and a locking J-plug and an exterior lockable metal cover. The location of each monitoring well will be logged with GPS technology with sub-meter accuracy. The locations of the monitoring wells will also be surveyed for elevations.

Newly-constructed monitoring wells will be developed and allowed a minimum of one-week to equilibrate with the surrounding formation. The development will be completed using a surge block and submersible pump. The surge block will be used inside the well to flush fine sediments from the sand filter. After the well is surged, a submersible pump will be lowered into the well and groundwater will be withdrawn. Temperature, pH, specific conductance and turbidity readings will be monitored and pumping will proceed until the discharge water meets a field turbidity value to 10 formazin nephelometric units/nephelometric turbidity units (FNU/NTU) or less or until the field turbidity does not improve for a period of two hours during active development.

4.8 Groundwater Gauging and Sampling

Groundwater levels will be measured across the monitoring well network on a quarterly basis for a period of one year following installation of all Phase 1 wells to evaluate Site-wide groundwater elevations and groundwater flow. Groundwater levels will be collected with an electronic water-level meter capable of measuring fluid elevation with an accuracy of 0.01 ft. When conducting comprehensive gauging rounds, all groundwater level measurements will be collected on the same day to provide a snapshot of the Site-wide conditions. At least six monitoring wells will be fitted with pressure transducers to document the seasonal fluctuations of groundwater levels. The pressure transducers will collect automated measurements every 30 minutes.

Groundwater samples will be collected from all newly-constructed monitoring wells and all existing Site monitoring wells that are deemed accessible and in good condition during Site reconnaissance. The feasibility of sampling the production wells, and whether such sampling will produce representative groundwater data, will be evaluated during Site reconnaissance. Groundwater samples will be collected on a quarterly basis for a period of one year following installation of all Phase 1 wells to characterize groundwater quality beneath the Site during varying seasonal conditions. Existing monitoring wells with dedicated sampling pumps will continue to be sampled with the dedicated pumps to maintain comparability with previous sampling results. Other groundwater samples will be collected using the methods described in the USEPA guidance document titled "Ground Water Sampling Procedure, Low Stress (Low Flow) Purging and Sampling" (USEPA, 2010). During purging, a water quality meter will be used to monitor water quality indicator parameters such as pH, conductivity, dissolved oxygen (DO), oxygen reduction potential (ORP), temperature, and turbidity. The field parameters will be recorded on monitoring well sampling data forms and submitted with the final RI summary report.

During each groundwater sampling event, groundwater samples will be analyzed for the following parameters:

- Dissolved TAL metals via USEPA Methods 200.7 / 200.8 / 245.2 / 6010C / 6020A / 7470A;
- Total cyanide via USEPA Method 335.4; and
- General chemistry including Fluoride via USEPA method 300, alkalinity via method SM2320B, and hardness via method 2340B;
- Nutrients including Chloride and Sulfate via USEPA method 300.0, Nitrate and Nitrite as N via USEPA method 353.2, ammonia nitrogen via USEPA method 350.1/350.3, and orthophosphate as P via USEPA method 365.1; and
- Total dissolved solids (TDS) and total suspended solids (TSS) via methods SM 2540C/D.

The initial groundwater samples collected adjacent to potential source areas will also be analyzed for the following additional parameters:

- TCL VOCs via USEPA Method 8260; and
- TCL SVOCs via USEPA Method 8270.

All groundwater samples submitted for analysis of dissolved metals will be field filtered using a standard 0.45 micron filter.

PCBs or pesticides in groundwater samples will not be analyzed for unless deemed warranted based upon their detection in source area soil samples or other locations. Similarly, unless warranted based upon the detection of VOCs or SVOCs in source area groundwater samples, the downgradient groundwater samples will not be analyzed for these parameters.

4.9 Surface Water and Sediment Sampling

Surface water samples will be collected from surface water bodies present at the Site to evaluate surface water quality. Samples will be collected from within RI Areas, if water is present in the feature, including:

- North-East Percolation Pond
- North-West Percolation Pond
- South Percolation Ponds

- Seep
- Cedar Creek
- Cedar Creek Reservoir Overflow Drainage
- Flathead River

The proposed surface water sample locations are shown on Figures 3 through 8 and summarized in Table 1. Samples will be collected by taking a grab sample directly from the water body using the sample collection container for each analysis. The location of each sample will be logged with GPS technology with sub-meter accuracy. Surface water samples will be collected on a quarterly basis for one year to evaluate seasonal variations in water quality.

As part of sample collection activities within the surface water features, surface water will be field analyzed with a water quality meter to evaluate water quality parameters including temperature, conductivity, pH, DO, and ORP. The water quality meter will be placed directly in the surface water feature and will be monitored until stable readings are observed. The readings will be recorded on a field datasheet and included as part of the RI Summary Report.

All surface water samples will be analyzed for the following parameters:

- Total recoverable TAL metals via USEPA Methods 200.2 / 200.7 / 200.8 / 245.2 / 6010C / 6020A / 7470A;
- Total cyanide via USEPA Method 335.4;
- General chemistry including Fluoride via USEPA method 300, alkalinity via method SM2320B, and hardness via method 2340B.
- Nutrients including Chloride and Sulfate via USEPA method 300.0, Nitrate and Nitrite as N via USEPA method 353.2, ammonia nitrogen via USEPA method 350.1/350.3, and orthophosphate as P via USEPA method 365.1; and
- Total dissolved solids (TDS) and total suspended solids (TSS) via methods SM 2540C/D.

The initial surface water samples collected within the percolation ponds will also be analyzed for the following additional parameters:

- TCL VOCs via USEPA Method 8260;

- TCL SVOCs via USEPA Method 8270;
- TCL PCBs via USEPA Method SW8082; and
- TCL Pesticides via USEPA Method 8081.

During each surface water sampling event, the discharge of Cedar Creek and Cedar Creek Drainage Overflow will be measured utilizing a mechanical current-meter method in accordance with Roux SOP 6.7. The stream channel cross section will be divided into numerous vertical subsections. In each subsection, the area will be obtained by measuring the width and depth of the subsection, and the water velocity will be determined using a current flown meter. The discharge in each subsection will be computed by multiplying the subsection area by the measured velocity and the total discharge will be computed by summing the discharge of each subsection.

A temporary staff gauge will be installed within the Flathead River to enable measurement of river level conditions immediately adjacent to the Site. For the Flathead River, the instantaneous discharge measurement from USGS Station 12363000, located down river of the Site, will be recorded. The temporary staff gage will be surveyed and correlated to the USGS station 12363000. River levels measured at the staff gauge will be used in conjunction with measured groundwater elevations to evaluate groundwater / surface water interactions.

Sediment samples will be collected from the same locations as surface water samples. Seasonal conditions and river stage will be taken into account when collecting sediment samples. It is anticipated the sediment sampling activities will be performed in spring conditions when river stage is at a low level and such that the Flathead River is most likely acting as a gaining stream. Sediment will be collected by grab sampling sediment immediately beneath the subsurface and placing in sampling jars for laboratory analysis. Gravel and larger sized grains will be removed from the sample by utilizing a size 10 sieve prior to packaging and shipment for laboratory analysis. The proposed sediment samples will be analyzed with the same analytical methods as soils described in Section 4.4.1 including grain size analysis and total organic carbon. The proposed locations are shown on Figures 3 through 8 and are summarized in Table 1.

4.10 Drywell Sampling

Dry wells and drainage structures associated with the former plant operations are shown on Plate 2. All accessible drains and basins will be inspected visually for potential impacts (staining, odors, etc.). Descriptions of observations will be noted in the field notebook. A sediment sample will be collected from each feature where feasible utilizing hand tools. Sediment will be sent for laboratory analyses and analyzed for the same analytical methods as soils described in Section 4.4.1.

A soil boring will be drilled at the location of Drywell 31, which based on historical Site drawings was potentially used as a discharge location for chemical wastes generated in the Lab Building. In addition, at least three soil borings will be completed to evaluate subsurface soils beneath additional dry well locations. The locations will be selected following evaluation of sediment screening and laboratory data.

4.11 Fate and Transport Evaluation.

As described in the RI/FS Work Plan Section 5.7, fate and transport evaluation will start during Phase I and be continued during Phase II. During the Phase I Site Characterization, analytical data and hydrogeologic data will be collected to facilitate fate and transport evaluation. Field data recommended for chemical fate and transport modeling is described in Table 3 of the MDEQ guidance document titled "Technical Guidance General Field Data Needs for Fate and Transport Modeling" (MDEQ, 2008).

As described in Section 5.3.2, soil data to be collected in Phase I relevant to fate and transport evaluation and geotechnical analysis includes total organic carbon, grain size, bulk density and moisture content analysis. As described in Sections 5.6.2 and 5.6.3, groundwater and surface water data relevant to fate and transport evaluation include field parameters such as pH, dissolved oxygen, temperature, and ORP, and analytical parameters listed in the nutrient and metal parameter list.

A description of the fate and transport evaluation to be conducted during the Phase I Site Characterization is described in Section 5.7 of the RI/FS Work Plan.

5.0 FIELD SAMPLING PROCEDURES

This section discusses the Standard Operating Procedures (SOPs) and sample designation procedures that will guide the Phase I field activities.

5.1 Standard Operating Procedures

Roux Associates has developed a set of SOPs that are applicable for the proposed Phase I field sampling and data collection program. The SOPs were developed following USEPA and other applicable standard protocols. A list of relevant SOPs is provided below and copies of the SOPs are provided in Appendix A.

- SOP 3.1 – Collection of Quality Control Samples for Water-Quality Data
- SOP 3.2 – Field Record Keeping and Quality Assurance/Quality Control
- SOP 3.3 – Sample Handling
- SOP 4.2 – Measuring Water Levels Using an Electronic Sounding Device
- SOP 4.3 – Purging a Well
- SOP 4.4 – Sampling Ground-Water Monitoring Wells for Dissolved Constituents
- SOP 4.5 – Surface-Water Sampling
- SOP 4.6 – Filtration of Ground-Water and Surface-Water Samples for Dissolved Metals Analysis
- SOP 4.7 – Measuring the Thickness of Separate-Phase Organic Liquids
- SOP 5.1 – Collection of Soil Samples for Laboratory Analysis
- SOP 5.2 – Collecting Stream-Bed, Pond, and Lagoon Sediment Samples
- SOP 5.4 – Screening Soil Samples for Volatile Organic Vapors Using a Portable Photoionization Detector
- SOP 5.5 – Soil Classification and Logging Procedures
- SOP 5.12 – Incremental Soil Sampling
- SOP 6.4 – Measuring Water Quality Parameters
- SOP 6.5 – Photo Documentation
- SOP 6.6 – Collection of GPS Information
- SOP 6.7 – Measuring Stream Discharge
- SOP 9.1 – Decontamination of Field Equipment

5.2 Sample Designation Procedures

All screening locations and analytical samples, including samples collected for QA/QC purposes, will be given a unique Site-specific sample identification number. The sample identification number will be used to track field-screening data and laboratory analytical results in the project database, as well as for presentation of the data in memoranda and reports. During the investigation, the sample numbers will be recorded in the field logbook and field datasheets, on the sample jars, and on the COC paperwork.

The Site-specific format will include the following structure:

1) Project Identification Code

   All samples collected during the RI will be labeled as "CF", to represent Columbia Falls Aluminum Company.

2) Sampling Location Type

   All samples will include an alpha identification code to identify the type of sample location:

   - SB = Soil boring
   - MW = Monitoring Well
   - SWP = Surface Water Point
   - SDP = Sediment Sampling Point
   - DS = Drainage Structure
   - SGP = Soil Gas Point
   - SGS = Soil Gas Screening
   - WC = Waste Characterization
   - ISS = Operational Area Incremental Soil Sample

3) Sample Location Number

   Each unique sample location will receive a unique numerical ID. Numerical IDs will start with "001" for each sample location type. For clustered monitoring wells (i.e., locations where water table and deeper screened monitoring wells are present) the deeper screened well will receive the letter "a" after the sample location number. Existing monitoring wells will retain their historically used identification.

4) Sample Media Type

All samples will include an alpha identification code to identify the type of sample media being collected:

- SO = Soil
- GW = Groundwater
- SW = Surface water
- SD = Sediment
- SG = Soil Gas
- ~~PW = Sediment Porewater~~
- WCS = Waste Characterization Solids
- WCL = Waste Characterization Liquids

5) Sample Interval

Multiple samples may be collected within the same borehole location for vertical delineation purposes. If multiple samples are collected, the sample identification will include the depth interval in feet below land surface from which the unique sample was collected.

6) QA/QC Samples

For samples collected for quality assurance / quality control purposes, the following alpha identification codes will be added to the sample ID:

- MS = Matrix Spike
- MSD = Matrix Spike Duplicate
- FB = Field Blank
- EB = Equipment Blank
- TB = Trip Blank
- DUP = Field Duplicate

Trip blanks and field duplicates will also be given unique identifiers indicating the type of sample and the sample date, but the analytical laboratory will be kept "blind" as to the location of field duplicate pairs to avoid introducing any bias to the analytical process.

The proposed samples and sample designations are provided on Table 1. Below are example sample designations for various types of hypothetical samples:

An example designation for a soil sample collected from 10-12 ft-bls at soil boring location 001:

CFSB-001-SO-10-12

An example designation for a groundwater sample collected from monitoring well 001:

CFMW-001-GW

DRAFT

PART 2 - COLUMBIA FALLS ALUMINUM COMPANY PHASE 1 SITE CHARACTERIZATION QUALITY ASSURANCE PROJECT PLAN

Prepared by Roux Associates
November 2015 - Revision #0

______________________________ ______________________________

Andrew Baris — Date
Vice President / Principal Hydrogeologist
RI/FS Project Manager

______________________________ ______________________________

Michael Ritorto — Date
Senior Hydrogeologist
RI Manager

______________________________ ______________________________

Wai Kwan, Ph.D., P.E. — Date
Senior Engineer/
Quality Assurance Manager

6.0 GROUP A – PROJECT MANAGEMENT

This element group, comprising nine elements, addresses project administrative functions and project concerns, goals, and approaches to be followed. The first element (A1) is the title and approval sheet provided above. The second element (A2) is the table of contents provided at the beginning of the SAP. The remaining items included in this element are addressed below.

6.1 Element A3 – Distribution List

This SAP will be distributed to the following organizations/key project personnel associated with the RI/FS activities.

Organization	Individual	Title	Copies
USEPA	Mike Cirian	EPA Project Manager	3 hardcopies and 1 electronic
Montana DEQ	~~Keith Large~~Lisa DeWitt	DEQ State Project Officer	1 hardcopy and 1 electronic
Glencore	John Stroiazzo	Glencore Project Manager	Electronic Only
CFAC	Steve Wright	Project Coordinator	Electronic Only
Roux Associates	Andrew Baris	RI/FS Project Manager	Electronic Only
	Michael Ritorto	RI Manager	Electronic Only
	Wai Kwan	QA Officer	Electronic Only
Primary Laboratory	TBD	Laboratory Project Manager	Electronic Only
Data Validation Firm	TBD	Data Validator	Electronic Only

6.2 Element A4 – Project/Task Organization

A project organization for the RI/FS is shown in Figure 11. The project responsibilities of the various key project team members relevant to the Phase I Site Characterization are discussed below.

RI/FS Project Manager – Andrew Baris, Principal Hydrogeologist, Roux Associates

The RI/FS Project Manager has the responsibility to oversee the overall implementation and completion of the RI/FS Scope of Work. The Project Manager will manage the technical and administrative aspects of the project and will function as Roux Associates primary contact with CFAC and the regulatory agencies (USEPA and MDEQ). The RI/FS Project Manager will direct the activities of the RI Field Manager, FS Manager, and other project staff, and will be supported by the QA Officer in the implementation of this QAPP. The RI/FS Project Manager is responsible for maintaining the official, approved QAPP.

RI Manager – Michael Ritorto, Senior Hydrogeologist, Roux Associates

The RI Manager will be the manager responsible for overseeing the implementation of the RI Scope of Work. The RI Manager will ensure that data collection is carried out according to the RI/FS Work Plan, and the various components of this SAP (FSP and QAPP). The RI Manager will also oversee any subcontractors for any task where subcontractors may be required (e.g., drilling, geophysical survey, etc.). The RI Manager will be responsible for communicating updates on the status of the RI tasks to the RI/FS Project Manager.

FS Manager – Charlie McGuckin, P.E., Principal Engineer, Roux Associates

The FS Manager is responsible for developing the Scope of Work and overseeing the various parts of the FS. The FS Manager will communicate with the RI/FS Project Manager and RI Manager during the design of the RI to collect data that can be used to support the FS.

QA Officer – Wai Kwan, Ph.D., P.E., Senior Engineer, Roux Associates

The QA Officer is a person independent of technical/data analysis responsibilities on the project that is designated to perform project QA/QC responsibilities. The QA Officer will assist as needed in ensuring compliance with this QAPP and the sampling protocols in the FSP. The QA Officer will be responsible for ensuring that sampling QA/QC audits are conducted to verify that data being collected during the RI meets the DQOs. The QA Officer will also be responsible for communicating with the analytical laboratory about potential QA/QC issues, if any, and managing the data validation subcontractors. The QA Officer will submit reports to the RI/FS Manager on QA activities and will verify that corrective measures are performed, if needed.

Project Health and Safety Officer – Joe Gentile, CIH, Corporate Health & Safety Officer, Roux Associates

Health and safety will be a shared responsibility of all project personnel that visit the Site during the RI/FS activities. The overall health and safety management during field activities will be stewarded by the Project Health and Safety Officer. The Project Health and Safety Officer will be responsible for ensuring that all project personnel, including subcontractors, adhere to the requirements in the HASP.

<u>Laboratory Project Manager – To be determined and specified in SAP Addendum</u>

The Laboratory Project Manager will be responsible for sample container preparation, sample custody in the laboratory, and completion of the required analysis through oversight of the laboratory staff. The Laboratory Project Manager will ensure that all QA/QC protocols specified in this QAPP are followed and that an acceptable laboratory report is prepared and submitted. The Laboratory Project Manager will report to Roux Associates' QA Officer and will also communicate directly, as needed, with the Data Validation Manager.

<u>Data Validation Manager - To be determined and specified in SAP Addendum</u>

Roux Associates will coordinate data validation through a third-party Data Validator. The Data Validator will be responsible for validating analytical data received from the laboratory to ensure it meets the DQOs outlined in the QAPP and USEPA data validation guidelines. The Data Validator will provide a summary of the data validation results for inclusion in the summary reports.

6.3 Element A5 – Problem Definition/Background

This element discusses the basis for the RI/FS activities at the CFAC Site, provides pertinent background information, and discusses the intended uses of the information to be developed during implementation of the RI/FS.

6.3.1 Basis for the RI/FS

Roux Associates, Inc., has prepared a RI/FS Work Plan for the CFAC aluminum facility Site located in Columbia Falls, Flathead County, Montana (hereinafter, "the Site"). The Site was operated as a primary aluminum reduction facility (commonly referred to as an aluminum smelter) from 1955 until 2009. Aluminum production at the Site was suspended in 2009 due to a downturn in aluminum market conditions, and CFAC announced the permanent closure of the facility in March 2015. Since that time, CFAC has initiated decommissioning and demolition activities and has commissioned the performance of an RI/FS. The purpose of the RI/FS is to characterize the nature and extent of risks associated with environmental conditions at the Site and to evaluate potential remedial options to address those risks. More specifically, the RI/FS is designed to achieve the following objectives:

1. Identify contaminants of potential concern (COPCs) at the Site and their source(s);

2. Determine the nature and extent of Site-related COPCs in environmental media (soil, soil gas, groundwater, surface water, sediment, and sediment porewater) at the Site;
3. Understand the fate and transport of COPCs in environmental media at the Site;
4. Identify any exposure pathways (considering both current and potential future land use);
5. Evaluate current and potential future human health and ecological risks posed by the COPCs present at the Site; and
6. Conduct an evaluation of remedial alternatives for the Site, including treatability studies where necessary.

6.3.2 Background Information

A Site description is provided in Section 2.1 of this SAP and a summary of Site operations is provided in Section 2.2 of this SAP. A summary of the physical setting of the Site, including a review of the Site topography, climate, geology, hydrogeology, and groundwater flow is provided in Section 2.0 of the RI/FS Work Plan.

Previous investigations conducted at the Site indicate the presence of COPCs (i.e., primarily cyanide and fluoride) in soil, groundwater, surface water and sediment. Additional data will need to be collected as part of the RI/FS is to characterize the nature and extent of the COPCs and further understand the potential environmental impacts, if any.

6.3.3 Intended Use of the Information

The information collected throughout the RI/FS will be utilized to achieve the objectives described in Section 6.3.1. Section 3.6 of the RI/FS Work Plan provides preliminary identification of potentially applicable or relevant and appropriate requirements (ARARs) and any other guidance and criteria "to be considered" (TBC) for the Site during the RI/FS. In addition, Section 6.5.5 discusses screening criteria to which the RI data will be compared for identification and selection of COPCs.

6.4 Element A6 – Project/Task Description

This element provides a description of the activities planned in the Phase I Site Characterization and a preliminary schedule of those tasks.

6.4.1 Phase I Site Characterization

A RI/FS Site Characterization Program will be implemented in a phased approach, anticipated to consist of at least two phases of field work. The Phase 1 Site Characterization will focus on identification and characterization of source areas, and providing broad characterization of conditions across the Site (including at downgradient areas near potential human and ecological receptors).

The Phase I Site Characterization program has been designed to identify and/or confirm source areas and associated COPCs, as well as provide a broad characterization of the hydrogeologic conditions and the nature and extent of contamination across the Site. Based on the current understanding of the Site conditions and CSM, the following objectives were established for Phase I Site Characterization Program:

- Evaluate current conditions at all identified RI areas and Site features to determine which RI areas and Site features require further investigation and/or quantitative evaluation in the baseline risk assessment;
- Refine the list of COPCs that require further investigation at various RI areas and Site features so lists of laboratory analyses can be reduced during subsequent phases of investigation;
- Refine the understanding of groundwater flow beneath the Site, particularly in the vicinity of potential receptors;
- Develop a more detailed understanding of bedrock topography and the depths, thicknesses and extents of the various hydrogeologic units, both of which may influence groundwater flow and the distribution of COPCs in the subsurface;
- Begin to evaluate seasonal influences on groundwater/surface water interactions and contaminant concentrations in groundwater and surface water;
- Develop data to support the preparation of the baseline risk assessment work plan; and
- Develop data to support identification and screening of remedial technologies as part of the FS.

To meet the objectives outlined above, the Phase I RI program will include additional historical data review, coordination of activities with the Site salvage/repurposing contractor (Calbag Resources, LLC), pre-intrusive Site reconnaissance work, and source, operational and background area investigation activities that will include soil gas, soil, groundwater, sediment, and surface water sampling activities. Each of these tasks are described in greater detail in Section 4.0.

6.4.2 Phase I Site Characterization Preliminary Schedule

A preliminary schedule for implementation of the major RI/FS activities is provided in Section 10.3 of the RI/FS Work Plan. A detailed project schedule outlining the anticipated timing and duration of each Phase 1 Site Characterization field task will be provided to the EPA once the RI/FS Work Plan and this SAP are approved and key subcontractors have been selected. Management of the schedule will be an important focus throughout the duration of all RI/FS activities. The schedule will be periodically reviewed and updated as the work progresses. Many of the tasks in the RI/FS are independent; however, where possible, tasks will be conducted concurrently to facilitate progress. The schedule may require modification throughout the duration of the RI/FS based upon, among other factors, the regulatory review and approval process, the availability of specialized subcontractors for certain aspects the work, adjustments to the scope of work.

6.5 Element A7 – Quality Objectives and Criteria for Measurement Data

The RI/FS Site Characterization Scope of Work was developed in a manner consistent with USEPA's "Guidance on Systematic Planning Using the Data Quality Objective Process" (USEPA, 2006). The data quality objective (DQO) process is designed to clarify the objectives of data collection and maximize efficiency during data collection. It consists of a multi-step, iterative process that ensures that the type, quantity, and quality of environmental data used in the decision making process are appropriate for its intended application. The following steps were completed as part of the DQO process in general accordance with the USEPA guidance:

1. Define the problem
2. Identify the Goals / Decisions of the Study
3. Identify Information Inputs
4. Define the Study Boundaries
5. Develop the Analytical Approach
6. Specify Performance or Acceptance Criteria

7. Develop the Plan for Obtaining Data

The remainder of this element summarizes the step-by-step DQO process.

6.5.1 Step 1: Define the Problem

The RI/FS Work Plan provides the background information and relevant existing Site data to define the problem. In summary, previous investigations indicate that former aluminum smelter operations at the Site have resulted in releases to the environment which may pose a potential threat to human health and the environment. It is necessary to understand the types, extent and concentrations of the COPCs that have resulted from former Site operations for the adequate evaluation of current and future human health and ecological risks. It is also necessary to identify and understand any potential ongoing sources of these COPCs, if any, in order to make informed decisions regarding potential remediation approaches. Additionally, it will be important to understand the Site physical characteristics in order to evaluate contaminant migration pathways and potential remedial action alternatives.

6.5.2 Step 2: Identify the Goals / Decisions of the Study

The overall goal of the RI/FS is to determine:

- Where and to what extent remedial action is warranted to protect human and ecological receptors from contamination at the Site; and
- The remedial action alternative(s) that best satisfies the remedy selection criteria specified within the USEPA guidance and NCP.

In order achieve the above goals, the RI/FS will be conducted in a phased approach starting with the Phase 1 Site Characterization Program that is the focus of this SAP. The objectives of the Phase I Site Characterization are presented in Section 6.5.1, and formed the basis for development of the following decision questions and statements.

- *Question 1*: Do inorganic and organic chemical concentrations in Site surface soil, subsurface soil, soil gas, surface water, sediment, and groundwater exceed project screening levels?

  Decision Statement: Determine if concentrations in Site surface soil, subsurface soil, soil gas, surface water, sediment, and groundwater are above screening levels and should be identified as COPCs.

- *Question 2*: What is the extent of COPCs in Site surface soil, subsurface soil, soil gas, surface water, sediment, and groundwater?

  Estimation Statement: Estimate the areal and vertical extent of COPC contamination in Site surface soil, subsurface soil, soil gas, surface water, sediment, and groundwater.

- *Question 3*: Do COPC concentrations in Site surface soil, subsurface soil, surface water, sediment, and groundwater exceed reference conditions?

  Decision Statement: Determine if COPC concentrations in Site surface soil, subsurface soil, surface water, ~~sediment porewater~~, sediment, and groundwater are statistically greater than reference concentrations and are identified as Site-related COPCs.

- *Question 4*: Are there potential source areas present at the Site, beyond those already identified in the CSM (i.e., landfills, percolation ponds, plant drainage system including dry wells, drum storage area, underground storage tanks [USTs], aboveground storage tanks [ASTs], and waste and raw materials storage and handling areas)?

  Decision Statement: Determine if additional source areas/Site features are present at the Site where COPCs potentially were released, based upon visual inspection of waste materials, soil piles, staining, stressed vegetation, etc., which will require additional characterization.

- *Question 5*: How are COPCs in Site surface soil, subsurface soil, and groundwater moving throughout the Site and is there the possible movement of COPCs ~~y~~ off-Site?

  Estimation Statement: Evaluate the fate and transport of COPCs throughout Site surface soil, subsurface soil, and groundwater. Parameters needed to inform this assessment include estimates of the depth to groundwater, identification of the aquifer types that are present (e.g., unconfined/confined, alluvial/bedrock), hydraulic gradients, as well as measurements of soil and water quality characteristics (e.g., total organic carbon, soil particle size and bulk density, pH, oxidation potential, alkalinity), the types and concentrations of COPCs across the Site and near downgradient Site boundaries, and the physiochemical properties of the COPCs present.

- *Question 6:* What are the subsurface characteristics and Site features that are important to understand prior to conducting drilling activities?

  Estimation Statement: Evaluate the geophysical nature of the subsurface characteristics and features of the Site. Parameters needed to inform this assessment include estimates of the depth to bedrock, estimates of the depth to groundwater, identify changes in subsurface hydrogeological conditions, identify subsurface anomalies that may contribute to the delineation of source areas, etc.

6.5.3 Step 3: Identify Information Inputs

An evaluation of current Site conditions based upon existing data and an identification of the data needed to complete the RI/FS is provided in Sections 3.0 and 4.1 of the RI/FS Work Plan. While the historical investigation data was useful for development of the preliminary CSM and scoping of the project, the available QA/QC documentation for the majority of the historical investigations is not sufficient to rely upon the data in future decision making. Therefore, the majority of the data for future decisions will be that which is collected during the RI/FS. This data will be supplemented by use of the validated data from the USEPA Site Reassessment sampling completed in 2013 and the ongoing quarterly residential well monitoring program (described in Section 2.8.14 and 2.8.15 respectively of the RI/FS Work Plan). In addition, the historical MPDES monitoring of historical groundwater quality trends and the ongoing MPDES Permit compliance monitoring will be used as appropriate.

A description of the data required to address each of the DQO questions and statements provided in Section 6.5.2 is summarized below.

- *Decision Statement:* Determine if concentrations in Site surface soil, subsurface soil, soil gas, surface water, sediment, and groundwater are above screening levels and should be identified as COPCs.

  In order make this determination, samples of the aforementioned media (with the exception of soil vapor) should be collected where present within, or adjacent to, each of the Site features that have been identified as potential source areas (i.e., landfills and percolation ponds) as well as from potential receptor locations (Site-wide soils, groundwater, surface water bodies). Groundwater samples should be collected adjacent to, and downgradient of, the potential source areas. Soil vapor does not require collection from all Site features, as VOCs have only been detected at trace concentrations to date. Passive soil vapor screening and groundwater data for VOCs can be used to evaluate the potential for soil vapor impacts and determine if additional soil vapor sampling is required.

  The aforementioned samples should be analyzed for a comprehensive suite of analytical parameters to provide a broad screening for potential COPCs at the Site. The maximum concentrations detected should be utilized to make comparisons to conservative screening criteria for the protection of human and ecological receptors.

- *Estimation Statement:* Estimate the areal and vertical extent of COPC contamination in Site surface soil, subsurface soil, soil gas, surface water, sediment, and groundwater.

  In order to estimate the areal and vertical extent of COPCs in the aforementioned media, samples will be collected at locations around, and downgradient of, the various potential source areas that have been identified at the Site. As part of the Phase 1 Site Characterization, the locations should provide a broad distribution of sampling locations across the Site and up to the downgradient Site boundary to assess if the COPCs are limited to within the Site boundary or potentially extend beyond the boundary. Within the groundwater system, installation and sampling of monitoring wells at deeper depths beneath the water table is required to characterize the vertical extent of COPCs.

- *Decision Statement:* Determine if COPC concentrations in Site surface soil, subsurface soil, surface water, ~~sediment porewater~~, sediment, and groundwater are statistically greater than reference concentrations and are identified as Site-related COPCs.

  ~~Soil samples will be grouped into decision units following review of the Phase I data and during preparation of the Baseline Risk Assessment Work Plan. These decision units will likely correspond to the preliminary exposure areas described in Section 3.2 of the RI/FS Work Plan, which include the Main Plant Area, Landfill Area(s), Northern Percolation Ponds, Operational Soil Area and the Flathead River landside Area (including Southern Percolation Ponds and the Seep area).~~

  With respect to surface and subsurface soil, a minimum of eight locations will be sampled within the western portion of the Site in areas that have had no evidence of prior industrial activity and that are greater than 500 ft from any known potential source area. The data from these locations will be used to calculate the mean concentration and 95 percent upper confidence limit (UCL) on the mean to establish potential background concentrations for comparison to soil samples collected at locations within ~~and around the Site features~~the decision units. In addition, the background concentrations from this effort will also be evaluated in the context of the prior background soil sampling at the Site by Weston (2014) and throughout the State of Montana by Hydrometrics (2013).

  With respect to groundwater, monitoring well W2-CFMW1 located within the Site boundary, but upgradient of all potential source areas, will be sampled to establish a background / reference concentration. With respect to surface water and sediment within Cedar Creek and the Cedar Overflow, two locations within the Site boundary but upstream of all potential source areas will be sampled to establish a background / reference concentration. Within the Flathead River, a background / reference location will selected during the field reconnaissance task of the Phase 1 Site Characterization. This location will be identified Phase 1 SAP Addendum described in Section 4.2. Since only one sample location will be used for the aforementioned background / reference stations, statistical analysis will not be performed. The data from these locations will compared directly to results of samples collected within and around the Site features.

- *Decision Statement:* Determine if additional source areas/Site features are present at the Site where COPCs potentially were released, based upon visual inspection of waste materials, soil piles, staining, stressed vegetation, etc., which will require additional characterization.

  A ground level field reconnaissance will be conducted prior to the commencement of sampling activities, as described in Section 4.3. The findings of this reconnaissance, including identification of any additional potential source areas/Site features requiring characterization, as well as any additional sampling proposed based upon those findings, will be documented in the Phase 1 SAP addendum.

- *Estimation Statement:* Evaluate the fate and transport of COPCs throughout Site surface soil, subsurface soil, and groundwater. Parameters needed to inform this assessment include estimates of the depth to groundwater, identification of the aquifer types that are present (e.g., unconfined/confined, alluvial/bedrock), hydraulic gradients, as well as measurements of soil and water quality characteristics (e.g., total organic carbon, soil particle size and bulk density, pH, oxidation potential, alkalinity), and the physiochemical properties of the COPCs present.

The hydrogeologic investigation has been designed to generate Site-specific data needed to evaluate the fate and transport of COPCs. The drilling program will include continuous coring to characterize formation materials at 43 new monitoring well locations throughout the Site. This will generate information regarding types and physical characteristics of the aquifers and confining units present, as well as collection of representative samples of aquifer materials and low permeability layers for geotechnical laboratory analysis. Monitoring wells will be installed to allow for measurement of depth to groundwater. These data used in conjunction with elevation surveys will be used to estimate hydraulic gradients. Published literature sources will be used to gather information regarding the physiochemical properties of COPCs that is required to evaluate fate and transport.

- *Estimation Statement:* Evaluate the geophysical nature of the subsurface characteristics and features of the Site. Parameters needed to inform this assessment include estimates of the depth to bedrock, estimates of the depth to groundwater, identify changes in subsurface hydrogeological conditions, identify subsurface anomalies that may contribute to the delineation of source areas, etc.

  The existing Site data has been evaluated to provide an initial understanding of subsurface conditions. Prior to initiating the drilling program, this initial understanding will be supplemented by conducting a geophysical survey in the vicinity of the Site landfills and along transects perpendicular to the strike of Teakettle Mountain as described in Section 4.4. In addition, Site topography and existing monitoring wells will be used to estimate the anticipated depth to groundwater and the types of subsurface materials expected to be present at each drilling location.

6.5.4 Step 4: Define the Study Boundaries

This section describes the spatial and temporal bounds of the RI/FS.

Spatial Bounds

As described in Section 2.1 and shown on Figure 1, the property owned by the Columbia Falls Aluminum Company is approximately 3,196 acres. However, the historic footprint of operations and a significant peripheral area consists of approximately 1,340 acres of land bounded by Cedar Creek Reservoir to the north, Teakettle Mountain to the east, Flathead River to the south, and Cedar Creek to the west. Therefore, the Site and horizontal extent of the RI study area is defined as shown on Figure 2, including the 1,340 acres described above. The RI study area will be expanded if required to define the nature and extent of contamination at the Site.

Published literature indicates that the bedrock surface defines the base of the regional groundwater flow system at the CFAC Site (Konizeski *et al*, 1968). Thus, bedrock surface will represent the maximum vertical extent of the RI Study Area beneath the Site. The goal of the vertical investigation will be to refine the hydrogeologic model of the Site including understanding deep regional groundwater flow and identifying potential contaminant pathways to receptors. The vertical extent may vary across the Site area depending on the vicinity to Site features including the Flathead River.

Background / reference sampling locations for soil, groundwater, surface water and sediment are described in Section 6.5.3. The locations have been selected such that Site-related impacts are not expected to occur in the reference locations. Eight background / reference locations for soil sampling have been preliminary identified in the western portion of the Site in an area where there has been no evidence of Site-related industrial activity. During the Site reconnaissance task, these locations will be inspected to document the soil types present and determine if they are sufficiently similar to other Site soils for use as reference locations. The proposed background locations for surface water / sediment in Cedar Creek and the background monitoring well location for groundwater are in the northern area of the Site, upstream / upgradient of any Site-related activities. A background / reference sampling location in the Flathead River will be identified during the Site reconnaissance task.

Temporal Bounds

The potential release and potential migration of COPCs from source areas may vary depending on seasonal influences on groundwater flow. Groundwater in the region is typically recharged from the surface water sources within the watershed including numerous reservoirs, ponds, streams and lakes and additionally through infiltration of precipitation. During spring, the melting of winter snow and increased seasonal precipitation causes a high river stage in the Flathead River. This results in the Flathead River recharging groundwater and acting as a losing stream. In contrast, in the late summer, the dry weather results in a decrease in river stage so that the Flathead River *becomes* a gaining stream (Konizeski *et al.*, 1968).

Since most stormwater drainage is directed to the various percolation ponds, the release and potential migration of COPCs from these ponds may be correlated to both individual precipitation events as well as seasonal variation.

As a result of the seasonal and shorter term influences, multiple rounds of water level measurements (including use of water level data logger in select wells) will be conducted. Groundwater and surface water will be conducted on a quarterly basis for one year (four rounds of sampling) to characterize the seasonal variation in water quality. One sediment sampling event will be conducted as part of the Phase 2 Site Characterization. It is anticipated that this event will occur in the spring prior to significant mountain snowmelt, when the Flathead River is expected to be receiving water from the groundwater system.

6.5.5 Step 5: Develop the Analytical Approach

The activities described in Section 4 were developed to collect the types of data identified information inputs required to address the decision statement and estimation statements specified in Sections 6.5.2 and 6.5.3. The analytical approach to address each decision statement is described below.

- *Decision Statement:* Determine if concentrations in Site surface soil, subsurface soil, soil gas, surface water, sediment, and groundwater are above screening levels and should be identified as COPCs.

  This determination will be made by comparison of maximum detected concentration of each potential COPC to human health and ecological screening levels for each media type, within each potential exposure area. For the purposes of identifying COPCs, the lowest value, across all sources, will be selected as the screening level. The screening level sources to be utilized are described in Section 6.1 and 6.2 of the RI/FS Work Plan.

- *Decision Statement:* Determine if COPC concentrations in Site surface soil, subsurface soil, surface water, ~~sediment porewater~~, sediment, and groundwater are statistically greater than reference concentrations and are identified as Site-related COPCs.

  With respect to surface and subsurface soil, a minimum of eight locations will be sampled within the western portion of the Site in areas that have had no evidence of prior industrial activity and that are greater than 500 ft from any known potential source area. The data from these locations will be used to calculate the mean concentration and the 95 percent upper confidence limit (UCL) on the mean to establish background concentrations for comparison to the maximum concentrations detected in soil samples collected at locations within and around the Site features. COPCs with maximum concentrations in soil exceeding the 95 percent UCL on the mean will be considered to be Site-related.

As described in Section 6.5.3, groundwater, surface water and sediment will not have a sufficient number of background / reference stations to permit a statistical analysis of background concentrations. The concentrations measured at the background / reference stations will be compared directly to the maximum concentrations of COPCs measured at the Site to make an initial assessment of whether the COPCs appear to be Site-related and evaluate if additional background sampling is warranted.

- *Decision Statement:* Determine if additional source areas/Site features are present at the Site where COPCs potentially were released, based upon visual inspection of waste materials, soil piles, staining, stressed vegetation, etc., which will require additional characterization.

  A ground level field reconnaissance will be conducted prior to the commencement of sampling activities, as described in Section 4.3. The findings of this reconnaissance, including identification of any additional potential source areas/Site features requiring characterization, as well as any additional sampling proposed based upon those findings, will be documented in the Phase 1 SAP addendum.

6.5.6 Step 6: Specify Performance or Acceptance Criteria

Performance or Acceptance Criteria is addressed by the QA/QC aspects of the project as well as by an assessment of potential decision error and uncertainty evaluation.

6.5.6.1 Quality Assurance / Quality Control

Quality Assurance and quality control (QA/QC) measures will implemented throughout the course of the Phase 1 Site Characterization as detailed within the QAPP portion of this SAP. These measures will minimize variability, mitigate the potential for false positive and/or false negative error, and increase the accuracy and defensibility of collected data. These measures include, but are not limited to, the following:

- Ensuring that that project personnel have the proper qualifications and training (Section 6.6);
- Establishing a process for management of project documents, data and records (Section 6.7);
- Requirements for testing, inspection, maintenance and calibration of field and laboratory instrumentation (Section 7.6 and 7.7)
- Collection and analysis of field QC samples (Section 7.5.1);
- Analysis of laboratory QC samples (Section 7.5.2);
- Assessment and oversight (Section 8.0)

The analytical results of sampling activities will be evaluated with respect the following data quality indicators: precision, accuracy, representativeness, completeness, sensitivity and comparability. The field and laboratory QC samples that will analyzed, including their frequency of collection/analysis and associated acceptance criteria (where applicable), are summarized in Tables 2 and 3.

The aforementioned data quality indicators are discussed in detail in the remainder of this section. Compliance with these criteria will be evaluated by the laboratory in accordance with laboratory SOPs and quality assurance procedures and any non-conformity identified shall be addressed in the lab reports. These criteria will also be evaluated during data verification and validation processes.

6.5.6.2 Precision

Precision is defined as a measure of the reproducibility of individual measurements under a given set of conditions. Field precision is assessed through the collection and measurement of field duplicates. The variability between field duplicates reflects the combined variation in concentration between nearby samples and the variation due to measurement error.

Precision will be evaluated in terms of relative percent difference (RPD) between two replicate samples. RPD can be calculated using the following equation:

$$RPD = [(C1-C2) / ((C1+C2)/2)] \times 100$$

When: C1 = The larger of the two concentrations.

C2 = The smaller of the two concentrations.

Duplicate soil samples are typically expected to be more variable than results from duplicate water samples due to the physical and chemical heterogeneity of the soil matrix. As a result, a RPD of 50% was selected for soil and sediment field duplicate samples and a RPD of 30% for groundwater and surface water field duplicates to be used as advisory limits for analytes detected in both the original sample and its field duplicate. RPDs greater than these limits will be noted during the data validation process. The objectives for RPDs between the original samples and their field duplicates are shown in Table 2.

6.5.6.3 Accuracy

Accuracy is a measure of the overall agreement of a measurement to a known value, which includes a combination of random error (precision) and systematic error (bias) components of both sampling and analytical operations. Accuracy in the field is assessed through the use of trip blanks and equipment blanks and through the adherence to all sample handling, preservation, and holding time requirements. The objective for trip blanks and equipment blanks is that no target compounds are present above the reporting limits (RLs).

Laboratory accuracy will be evaluated through the analysis of laboratory method blanks, and spiked samples/compounds such as matrix spike and matrix spike duplicates (MS/MSDs), laboratory control samples (LCSs), and surrogate compounds. Method blanks should not contain any target compounds above the RLs which are quantitation limits based on the low point of calibration. For spiked samples/compounds, the accuracy objectives, as measured by percent recoveries (%R) are the control limits provided in Table 3.

6.5.6.4 Sensitivity

Sensitivity is the ability of a laboratory instrument or measurement technique to detect an analyte at certain levels of interest. Sensitivity of the analytical measurement techniques is demonstrated by laboratory method detection limits (MDLs) and Practical Quantification Limits (PQLs). MDLs represent the lowest reportable concentration of an individual compound that meets the analytical method qualitative identification criteria. PQLs refer to a minimum concentration of an analyte that can be measured within specified limits of precision and accuracy; they are generally 5-10 times the detection limit. MDLs and PQL are based on laboratory performance relative to established calibration standards. Compounds detected at concentrations below the PQL are qualified as “J”, estimated value.

In order to evaluate the sampling results relative to analytical approach outlined in Section 6.5.5, PQLs will be at or below the most conservative human health or eco-toxicity based benchmark value, to the extent feasible. These values will be specified in Tables 7 through 10, and will be utilized to establish sensitivity requirements for the selected analytical laboratory(s).

Monitoring of instrument sensitivity is performed through the analysis of reagent blanks, near detection limit standards, and response factors. Documentation of laboratory instrument sensitivity can be provided by the laboratory upon request. Sample matrix cleanup (in laboratory) must occur when chemical interferences may be causing elevated reporting limits or inadequate contaminant identification or quantitation.

6.5.6.5 Completeness

Data are considered complete when a prescribed percentage of the total intended measurements and samples are obtained. Analytical completeness is defined as the percentage of valid analytical results requested. Field completeness is a measure of the amount of valid measurement data collected for the project. The percent completeness can be calculated by the following equation:

$$\text{Completeness (percent)} = \frac{\text{(Valid Data Obtained)}}{\text{(Total Data Planned)}} \times 100$$

The target completeness objective for field measurements collected for this sampling program is 95 percent or more. The target completeness objective for laboratory analysis during the RI is a minimum of 90 percent of the planned collection of individual samples.

6.5.6.6 Representativeness

Representativeness is a qualitative parameter, which is dependent upon the proper design of the sampling program and proper laboratory protocol. Representativeness expresses the degree to which data accurately and precisely represents a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition.

Representativeness of field measurements is dependent upon the proper design of the sampling program. The Phase I RI sampling activities were designed to provide data that are representative of conditions at specific locations and times of sample collection. Representativeness will be verified by ensuring that the FSP and SOPs are followed throughout the RI activities.

In evaluating representativeness, it is important to understand the extent to which bias is incorporated by design into the sampling process. With respect to the Phase 1 source area investigation activities, field reconnaissance will be conducted first, followed by geophysical surveys and soil gas surveys. As described in Section 4.1, the findings from these activities will be evaluated and used to refine source area sample locations such that they are biased towards areas where COPCs are considered more likely to be present. ~~Thus, the results from Phase 1 sampling around source areas will likely be biased high relative to average conditions within the source area.~~

6.5.6.7 Comparability

Comparability is a qualitative objective, which expresses the confidence with which one data set can be compared with another. The objective for comparability is to ensure that results of analyses can be compared with analyses produced by other laboratories and other projects.

The data from historical investigations was utilized in conducting the initial site evaluation presented in the RI/FS Work Plan. However, the RI/FS is anticipated to generate data of sufficient quantity and quality such that reliance upon data from the prior investigations conducted in the 1980s and 1990s will not be necessary when conducting risk assessment and feasibility study.

Comparison to some more recent data sets may be informative and beneficial when evaluating sampling results and trends. The field sampling procedures and analytical methods proposed for the Phase 1 Site Characterization program are very similar to those used during the USEPA 2014 Site Reassessment as well as for the ongoing quarterly monitoring of residential wells. Therefore, the data collected from similar locations under similar conditions should be comparable. In addition, Phase 1 Site Characterization analytical methods for cyanide and fluoride are consistent with those used to monitor MPDES permit compliance. Therefore, seep, surface water and/or groundwater samples collected from similar locations under similar conditions should be comparable.

Comparability is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the protocols described in the FSP and QAPP are followed and that proper sampling and analytical techniques are used. The sampling and analysis throughout the Phase 1 Site Characterization will be conducted in accordance with the SOPs and selected analytical methods. Therefore, these procedures and methods will provide comparable data.

6.5.6.8 Decision Error Limits and Uncertainty Evaluation

As described below in Section 6.5.7, the sampling plan for the Phase 1 SAP was developed based upon judgmental sampling design, which is one of the accepted methods described in USEPA guidance on sampling design (USEPA, 2002b). Quantitative analysis of decision error limits and uncertainty is not feasible when implementing a judgmental sampling program. However, as described within the sampling plan, the proposed sample locations are biased to be within and around known or suspected source areas, and at locations downgradient of these areas. The analytical approach calls for using the maximum concentrations detected in these samples for comparison to the most conservative screening criteria or background / reference samples. This approach is overall a ~~very~~ conservative approach that should minimize ~~and minimizes~~ the potential for a Type 1 decision error (i.e., an analyte would be dismissed as a COPC when it could be of potential risk).

6.5.7 Step 7: Develop the Plan for Obtaining Data

As described in Section 4.2, several different types of data gathering and sampling activities are required to achieve the project objectives. The locations and numbers of sampling points associated with each type of activity were typically selected based upon judgmental sample design. As described in USEPA guidance on sampling design (USEPA, 2002b), judgmental sampling design is appropriate when there is reliable historical and physical knowledge about the feature or condition under investigation; or, when the objective of the investigation is to screen an area(s) for the presence or absence of contamination at levels of concern, such as risk-based screening levels. Both of these conditions are generally applicable for the current phase of work. Specifically, there is knowledge about most Site features (i.e., locations and dimensions, historical use) and the goals of the Phase 1 Site Characterization program include use of risk-based screening levels to identify areas for further investigation and/or inclusion in subsequent risk assessment.

Although the sampling plan for known or suspected source areas is judgmental in design, it will be conducted using a systematic phased approach. Field reconnaissance will be conducted first, followed by geophysical surveys and soil gas surveys. The findings from these activities will be evaluated and used to refine source area sample locations such that they are biased towards areas where COPCs are considered more likely to be present.

Judgmental sampling design has also been used to develop the scope of work for investigation of hydrogeologic and groundwater quality conditions at the Site. Per USEPA guidance, judgmental design is appropriate considering the scale of the Site and lack of adequate probabilistic investigation methods.

A stratified random sampling approach will be utilized as per USEPA guidance on sampling design (USEPA, 2002b) and the Interstate Technology & Regulatory Council (ITRC) Incremental Sampling Methodology (ITRC, 2012) to characterize soil quality conditions in the surface soil and shallow subsurface soil (0 to 0.5 ft-bls and 0.5 to 2.0 ft-bls, respectively) within large areas of the Site where there are no specific source areas identified, but aerial photographs or Site knowledge suggests evidence of historical operations activity. As described in Section 4.6.2, an incremental sampling methodology will be utilized in these areas to produce a better estimate of average soil conditions within individual grid cells uniformly distributed across the large area.

6.6 Element A8 – Special Training Requirements/Certifications

The RI Field Manager will ensure that all field team members have received project-specific training with respect to the various field sampling tasks and equipment operation and are knowledgeable in the applicable SOPs.

Prior to beginning field sampling activities, field planning meeting(s) will be conducted to discuss and clarify the following:

- Objectives and scope of the fieldwork
- Equipment and training needs
- Field operating procedures, schedules of events, and individual assignments

- Required quality control (QC) measures
- Health and safety requirements

It is the responsibility of each field team member to review and understand all applicable governing documents associated with this sampling program, including the FSP, QAPP and HASP.

All individuals involved in the collection, packaging, and shipment of samples must have OSHA 40-hour health and safety training, and respiratory protection training as required by 29 Code of Federal Regulations (CFR) 1910.134. Individuals involved in investigations at the asbestos landfills or other locations where asbestos is suspect must also have asbestos awareness training, as required by 29 CFR 1910.1001. All training documentation will be stored in the project files. It is the responsibility of the Health and Safety officer to ensure that all training documentation is up-to-date and on-file for each field team member.

Subcontractors will be utilized throughout the RI activities to complete various tasks. These tasks include sonic-drilling, geophysical surveying, land surveying, and asbestos characterization. The subcontractors will be selected prior to the completion of Site Reconnaissance and will be discussed in the SAP addendum. The subcontractors will be required to hold licenses/certifications as applicable for their respective tasks.

All analytical laboratories participating in the analysis of samples for the Phase I Site Characterization are subject to national, local, and project-specific certifications and requirements. Each laboratory will meet Environmental Laboratory Accreditation standards as defined by the USEPA. Copies of all proficiency examinations and certifications are maintained by the laboratory coordinator within each laboratory. Each laboratory also maintains appropriate certifications from the state and possibly other certifying bodies for methods and parameters that may also be of interest to the project. These certifications require that each laboratory has all applicable state licenses and employs only qualified personnel.

6.7 Element A9 – Documentation and Records

The following sections provide an overview of the procedures and requirements for recordkeeping and reporting. Field logbooks and field datasheets will provide the means of recording the data collection activities during field activities. All field logbooks and data sheets will be scanned on a weekly basis to create a PDF files for electronic archiving with the central project file. An SOP for field recordkeeping is provided in the SAP. Some of the specific requirements with respect logbooks and field data are highlighted below. Additionally, reporting of data collected and responsibilities related to reporting are discussed below.

6.7.1 Field Logbooks

Field logbooks will be used to document field activities and observations. The field notes will be clear, with sufficient detail so that events can be reconstructed later if necessary. Field logbooks will document any field deviations from the RI/FS Work Plan and/or SAP, as well as the reasons for the changes. Requirements for logbook entries include the following:

- Separate field activity logbooks will be kept for each task.
- Logbooks will be bound, with consecutively numbered pages.
- Removal of any pages, even if illegible, is prohibited.
- Entries will be made legibly with black (or dark) waterproof ink.
- Unbiased, accurate language will be used.
- Entries will be made while activities are in progress or as soon afterward as possible (the date and time that the notation is made will be noted as well as the time of the observation itself).
- Each consecutive day's first entry will be begun on a new, blank page.
- The date and time, based on a 24-hour clock (e.g., 0900 a.m. for 9 a.m. and 2100 for 9 p.m.), will be recorded on each page.
- When field activity is complete, the logbook will be entered into the permanent project file.

In addition to the preceding requirements, the person recording the information will initial and date each page of the field logbook. If more than one individual makes entries on the same page, each recorder will initial and date each entry. Logbook corrections will be made by drawing a single line through the original entry, allowing the original entry to be read. The corrected entry will be written next to the original entry. Corrections will be initialed and dated. Separate logbooks for each activity may be needed because several field activities may occur at once.

6.7.2 Field Datasheets

Field datasheets will be utilized when appropriate to achieve efficient and standardized recording of field measurements and observations. The type of field data sheet and the information recorded on it may vary by activity. At a minimum, field datasheets will be completed for each sample to document the unique sample identifier assigned, provide information on whether the sample is representative of a field sample or a field-based quality control sample (e.g., field blank, field duplicate), provide information regarding the sample media, sample date, sample location, sample GPS coordinates, and sampling team members for every sample. All datasheets must be entered into electronic format. Datasheets may also be used to document information such as habitat descriptions, sediment sample characteristics (e.g., color, texture, etc.), water level gauging data, surface water and groundwater sample field observations and measurements (e.g., pH, temperature, color, clarity, etc.). A reference date and activity will be entered into the logbook to refer to the field data sheets being generated. The field data sheets will be put into electronic format and become a permanent record within the project file. When field data sheet entries are entered in an electronic format, each sheet will be annotated to indicate who completed the data entry and when.

6.7.3 Data Storage

In addition to data collected during field activities as listed in sections 6.7.2 and 6.7.3, other data that will need to be maintained throughout the RI/FS will include laboratory analytical data, photographs, project correspondence (i.e., letters and emails), and deliverable reports. In general, all project documents will be maintained in electronic format and stored in a project specific folder designated on the Roux Associates network. All electronic files will be backed up in accordance with Roux Associates IT Policy.

All data generated by the laboratories will be requested in electronic data deliverable (EDD) format. The laboratory data will be imported into the project database and managed in accordance with the data management procedures outlined in Section 7.10 of this QAPP.

One copy of all final documents submitted by Roux to a client or regulatory agency is maintained in a central digital repository. Archiving of the digital repository occurs at a minimum daily. All other project files for completed projects will be retained for seven years from the date of completion of the project, unless a longer period is required by the client or EPA. Project completion refers to completion of all work at the Site, not the completion of individual phases or tasks.

6.7.4 Reporting

A list of project deliverables is provided in Section 9.0 of the RI/FS Work Plan. Reporting will be completed in hardcopy and electronic formats and submitted to the EPA and DEQ in accordance with the deliverable list outlined in Section 6.1. The RI/FS Project Manager will be responsible to ensure all project deliverables are completed on-time and submitted in accordance with the procedures outlined in Section 6.1.

7.0 GROUP B – DATA GENERATION AND ACQUISITION

This element group, comprising ten elements, addresses data generation and data acquisition and management activities.

7.1 Element B1 – Sampling Process Design

The Phase I RI sampling design is summarized in Section 5.0 of the RI/FS Work Plan and Section 4.0 of this SAP. All of the data planned to be collected in the Phase I Site Characterization will be considered critical to the process, and no secondary data is currently planned.

The Phase I Site Characterization is scheduled to begin in the 2nd Quarter of 2016. A general schedule for completion of each field task associated with Phase I will be provided to the USEPA Project Manager at least 30 days before the start of the field work activities. Because the Site is owned by CFAC, it is not anticipated that any of the sampling sites will become inaccessible during the field activities. However, if at any time the sampling locations described in the Phase I Scope of Work become inaccessible, CFAC will communicate with the USEPA Project Manager either orally or written within 24 hours.

7.2 Element B2 – Sampling Methods

Details regarding sampling procedures are presented in Section 5.1 of this SAP, including a summary of the relevant SOPs that will be used to guide the Phase I sampling activities.

If problems arise or field conditions suggest a deviation from the SOPs is required, the RI Manager should be contacted. A plan to adequately address the situation should be developed and documented in the field notebook.

If problems occur related to sampling equipment malfunctions, the RI Manager should be contacted. The RI Manager will be responsible for verifying that corrective actions are completed, such as obtaining backup supplies and equipment to ensure that the field activities will continue until completion. Any equipment malfunctions should be noted in the field notebook with a description of the date, time and problem. When replacement equipment arrive onsite, it should also be documented in the field notebook, including the source of the equipment and serial number.

7.3 Element B3 – Sample Handling And Custody

This element describes the management approaches that will be implemented to ensure that field samples retain their original physical form and chemical composition through collection to final disposal. Management approaches discussed below include sample designation, handling, and custody.

7.3.1 Sample Designation

All screening locations and analytical samples, including samples collected for QA/QC purposes, will be given a unique Site-specific sample identification number. The Site-specific sample designation is described in Section 5.2 of this SAP.

7.3.2 Sample Handling

The following sections summarize how sample custody will be managed during the course of the RI/FS.

7.3.2.1 Sample Labels

Each sample container will be affixed with a waterproof, adhesive label. The sample labels will contain the following information:

- Project name;
- Sample Date;
- Sample time;
- Sample identification;
- Sampler's initials;
- Requested analysis; and
- Sample preservative.

Preprinted sample labels will typically be prepared prior to sampling tasks. Labels that are not preprinted, and those portions of the label that must be completed in the field (i.e., date, time, sampler's initials), will be completed using waterproof ink. The label will be covered with clear mailing tape in an effort to prevent it from falling off and to prevent potential water damage during transit.

7.3.2.2 Sample Shipping and Hold Times

Most analytical methods require that samples be kept at an approximate temperature of four degrees Celsius (4°C). Samples requiring this type of preservation will be placed in coolers directly after collection and packed with ice. A temperature blank should be included in each sample cooler. Field personnel are responsible for the security and for maintaining the temperature of the samples before they are transferred to the analytical laboratory.

Sample bottles will be packed snugly with packing material in an effort to protect the containers from potential breakage during shipment. The samples, along with a completed chain of custody (CoC), will be stored inside the coolers at the Site until they are sent to the laboratory for analysis. All samples will either be shipped by overnight courier (e.g., Federal Express) or transported by vehicle to the laboratory for analysis. All containers shipped by courier to the laboratory will be sealed with a custody seal that has been signed and dated. Samples will be shipped or transported with sufficient time to meet all analytical holding standards. Tables 4 and 5 list container types and sizes, preservation, and holding times for the various analyses to be performed.

7.3.3 Sample Custody

The possession and proper transfer of samples and sample-related information must be documented from the time the samples are collected until the analyses have been completed and the data have been accepted. The objective of the sample custody system is to ensure that:

- Samples are uniquely identified and labeled;
- The correct samples are analyzed and are traceable to their records;
- Samples are protected from loss or damage;
- Alteration of samples (e.g., filtration, preservation) is documented;
- A forensic record of sample integrity is established; and
- Client confidentiality is maintained.

The CoC form establishes the documentation and control necessary to identify and trace a sample from collection to final analysis. All field staff responsible for collecting and sending samples to the laboratory will receive a copy of a blank CoC form following selection of the laboratory. The following sections summarize how sample custody will be managed during the course of RI.

7.3.3.1 Field Chain of Custody Procedures

The field sampler(s) is responsible for the care and custody of the samples until they are transferred or properly dispatched. The field sampler(s) will complete the CoC form immediately after collection in an effort to establish sample custody in the field before sample shipment. The following information will be included on the CoC:

- Sample identification and sample container identification number, if applicable;
- Date and time the samples were collected;
- Matrix of the sample;
- The number of containers for each sample;
- Analysis requested and preservation codes;
- Name of sampler(s) and the person shipping the samples and documentation;
- Name, telephone number and email address of the RI Project Manager; and
- Signature of the sampler.

Any corrections to the CoC will be made by putting a single strike through the incorrect entry and initialing and dating it. When the shipping container (i.e., cooler) is packed for shipping, personnel relinquishing the container will sign the CoC. The CoC will accompany the samples to the laboratory and a copy of the CoC will be retained by the RI Field Manager and placed in the project file. The completed CoC will be supplied by the laboratory with the standard data package.

The QA/QC Officer will be responsible for reviewing all sampling activities to verify whether proper custody procedures were followed during the field work. Any deviations in the custody procedures will be noted in the RI Summary Report.

7.3.3.2 Transfer of Custody and Shipment Procedures

Samples will be sent to the laboratory for analysis with a signed CoC. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the CoC. This record documents transfer of custody of samples from the sampler to the laboratory. The original CoC form will accompany the shipment, and a copy will be retained by the field manager to be placed in the project files. Photocopies of the original CoC should be made before shipment, if possible, in an effort to ensure that clean copies can be made later.

Shipping coolers will be locked and secured with tape and custody seals for shipment to the laboratory. If the samples are sent by common carrier, a bill of lading (air bill) must be used. Receipts of bills of lading will be retained in the project files. Commercial carriers are not required to sign off on the custody form as long as the custody forms are sealed inside or on the outside of the sample container and the custody seals remain intact.

7.3.3.3 Laboratory Chain of Custody Procedures

The Laboratory project manager will verify that CoC records are filled out upon receipt of the samples and will note questions or observations concerning sample integrity, if any. The name of the person receiving the samples and the date and time the samples were received by the laboratory should be noted on the CoC.

The laboratory project manager will verify that sample-tracking records are maintained. These records will follow each sample through all stages of laboratory processing. The sample tracking records must show the date of sample extraction or preparation and the date of instrument analysis. These records will be used, in part, in an effort to determine compliance with holding time requirements. Laboratory custody procedures for sample receiving and log-in, sample storage, tracking during sample preparation and analysis, and storage of data are described in the Laboratory QAPP.

7.4 Element B4 – Analytical Methods

All field and laboratory analytical methods to be employed during implementation of the RI/FS were chosen based on one or more of the following criteria:

- the ability to meet the DQOs for the project;

- the validity and reproducibility of the methods; and
- conformance of the methods to industry-standard or USEPA-published methods and practices.

The remainder of this Section describes the field and laboratory methods selected for the Phase I RI Site Characterization activities.

7.4.1 Field Analyses

Field instruments and equipment are those pieces of equipment used to gather or generate environmental data. The primary field instrumentation that is expected to be used during the RI includes:

- Multi-parameter meters to measure water quality parameters, including water temperature, specific conductance, dissolved oxygen concentration, pH, ORP, and turbidity;
- Oil/water interface and water-level probes to measure fluid levels;
- Submersible groundwater pumps and/or bladder pumps for use during groundwater sampling activities;
- PIDs for air monitoring, soil gas screening and soil screening;
- Methane meter for landfill soil gas screening;
- Multi-gas meter for air monitoring; and
- Handheld GPS for geo-referencing sampling locations.

A summary of the field instrumentation that is expected to be used during the RI/FS is provided in Table 6.

7.4.2 Laboratory Analyses

The selected analyses for the Phase I sampling activities are described for each media in Section 4.0.

The laboratory's SOPs specify equipment, method-specific performance criteria, and corrective actions for each method. A summary of methods for each media is also provided in Tables 7 through 10. These tables include the desired maximum PQL expected for each analyte that has an established human health or eco-toxicity benchmark / criteria value. The expected MDLs and PQLs that can be achieved by the laboratory will be provided following selection of the laboratory. Any methods that cannot meet the desired quantitation limits, if any, will be discussed in the SAP addendum.

7.5 Element B5 – Quality Control

Overall data usability is influenced by variability (error) introduced into and/or inherent with both field (sampling) and laboratory (analytical) processes. QC checks are tools with which to measure or estimate the overall effect of this variability on a sample collection effort. During implementation of the RI/FS, a variety of QC checks will be performed by both field and laboratory staff to assess compliance with project DQOs and the SOPs for the various analytical methods. These QC checks are discussed below.

7.5.1 Field QC Checks

This section provides a description of field QC procedures. QC samples will be collected in the field to estimate precision and accuracy of the analytical results and to examine the sources of error introduced by the field practices. The results of the QC checks are used during data validation in an effort to evaluate the precision, accuracy, sensitivity, and representativeness of the overall sampling and analytical program. The following sections describe the QC checks that will be applied to the RI and their definition and purpose. The frequencies of field QC samples for the RI field activities are specified in Table 2.

7.5.1.1 Field Duplicates

A field duplicate is a field sample that is collected at the same place and time as an original field sample. However, because of potential variation in field duplicate samples (even those from similar locations, especially for media such as soil, surface water, sediment, etc.), it is not appropriate to assume that field duplicate pairs must necessarily have the same concentration values. Rather, field duplicates help to evaluate variability due to small-scale media heterogeneity, along with analytical precision. During the RI, duplicate samples will be collected at a minimum frequency of one per twenty samples and one per sample delivery group.

7.5.1.2 Trip Blanks

Trip blanks are used to assess the potential for bias (inaccuracy) through the introduction of volatile contaminants into the sample or sample containers during transport, handling, and/or storage. Trip blanks determine if any cross-contamination between sample containers occurs from the proximity of sample containers to one another during transport or storage. Trip blanks consist of sample containers filled with analyte-free water that are preserved with hydrochloric acid (HCL) and prepared by the laboratory prior to the sampling event. The trip blanks are then transported to the field along with the containers used for sample collection and are kept with the samples throughout the sampling event, but are not exposed to the sampling process. Once sampling is complete, the trip blanks are then packaged for shipment with the other samples and sent for analysis. The trip blank sample containers are not opened before they reach the laboratory to be analyzed. There should be at least one trip blank included in each shipping container that contains samples for VOC analysis.

7.5.1.3 Equipment Blanks

Equipment blanks (also referred to as decontamination rinsate blanks) are samples that are obtained by running de-ionized water through decontaminated sampling equipment as a check that the decontamination procedure has been adequately carried out and that there is no cross contamination of samples occurring due to the equipment itself. Equipment blanks must be analyzed for the same parameters as the associated samples. One equipment blank will be taken per day as needed when reusable sampling equipment is utilized.

7.5.1.4 Temperature Blanks

Temperature blanks ensure that samples arrive to the laboratory at the correct preservation temperature. Temperature blanks typically consist of de-ionized water and will be included in each cooler when it is shipped to the laboratory. The laboratory sample custodian will record the temperature of the blank upon receipt of the samples.

7.5.1.5 Matrix Spikes and Matrix Spike Duplicates

Matrix Spike (MS) and Matrix Spike Duplicate (MSD) samples are designed to evaluate the effect of the sample matrix on analytical data, by measuring precision and accuracy from a known concentration of a target analyte that has been added to a particular sample matrix.

MS/MSD samples are prepared by spiking environmental field samples with a standard solution containing known concentrations of representative target analytes. Percent recovery of each of the spiked compounds or analytes reflects the ability of the laboratory and method to accurately determine the quantity of the analyte in that particular sample (i.e., is a measure of accuracy in the specific sample matrix).

For the MSD samples, a second aliquot of the same field sample used for the MS is combined with the same quantity of the spiking compounds and is processed in an identical manner. The results for the MS/MSD pair provide a measure of the precision during laboratory analysis.

Additional sample volumes for MS/MSD QA/QC samples will be collected in the field at a minimum frequency of one per twenty samples. MS and MSD samples will be identified on the CoC for the analytical laboratory.

7.5.1.6 Field Blanks

A field blank is a sample of the same medium as field samples, but which does not contain any contaminant. Field blanks are normally collected for air and water samples, but not for soil or sediment. A field blank for surface water will be prepared by placing an appropriate volume of analyte-free reagent water (e.g., ASTM Type II) into a sample collection container. Field blanks must be analyzed for the same set of parameters as the surface water samples. Field blanks will be collected at a rate of 1 field blank per 20 field samples or 1 per sample batch, whichever is greater.

7.5.2 Laboratory QC Checks

The analytical laboratories have a QA/QC program in place to ensure the reliability and validity of the analysis performed at the laboratory. All analytical procedures are documented in writing in laboratory SOPs and each SOP includes the minimum requirements for the procedure. The internal QA/QC checks differ slightly for each individual procedure.

Laboratory QC check samples serve as checks on the laboratory sampling and measurement systems and assist in determining the data quality with regard to laboratory accuracy and precision. The number and type of laboratory QC check samples varies with the intended data use. Laboratory control samples fall into two basic categories: samples run through the entire sample allocation, preparation, and analysis method (method or matrix controls) and samples run through only the analysis method (analysis or instrument controls). In either case, control samples are samples of known or certified concentration that are introduced at either the pre-preparation or post-preparation step of the method and carried from that point on through the rest of the method as a routine sample.

Control samples are used in an effort to define either method (preparation plus instrument) or instrument accuracy. Method (preparation) performance check samples collectively measure the entire laboratory analytical data generation process, from sample allocation in the laboratory through the analysis and data reduction. Instrument (analysis) check samples measure the laboratory performance from the point where analysis begins, generally excluding any preparation/extraction effects, through the analysis and data reduction.

Laboratory analytical QC will be monitored through internal laboratory QC checks such as the analysis of blanks, matrix spikes, matrix spike duplicates, surrogate spike, laboratory control samples, and initial and continuing calibration checks. The frequency, acceptance criteria, and corrective action for these laboratory QC checks per analysis will be in accordance with method requirements and the individual laboratory QAPPs.

7.5.2.1 Method and Analytical Blanks

Method blanks are generated within the laboratory during the processing of the field samples. These blanks are processed using the sample reagents and procedures at the same time as the samples being analyzed. Contamination found in the method blank would indicate that similar contamination found in associated samples may have been introduced in the laboratory, and not actually be present in the samples.

Analytical blanks, such as initial calibration blanks and continuing calibration blanks are required by inorganic test methods. These blanks are laboratory reagent-grade water and acid solutions to match samples analyzed at the beginning, intervals during, and the end of an analytical sequence in an effort to assess contamination and instrument drift. The initial calibration blank is analyzed at the beginning of the analytical run following the calibration and initial calibration verification. The continuing calibration blank is analyzed prior to sample analyses, throughout the analytical run and at the end of the analytical sequence, or as stipulated in each analytical method.

7.5.2.2 Surrogate Spikes

Surrogate spike analyses are used to determine target analyte recovery during sample preparation and analysis. A surrogate spike is prepared by adding a known amount of surrogate compound to an environmental sample before extraction. Surrogates are similar to matrix spikes and apply only to organic parameters. The surrogate compound is chosen to exhibit an analytical response similar to the response displayed by a target compound during sample analysis. The recovery of these surrogates aids the analysts in determining matrix effects on recovery of compounds in each sample and is a measure of accuracy. Surrogate spikes generally do not affect the routine sample results because the surrogate compounds are isotopically labeled. Surrogate spike analyses will be conducted in accordance with the referenced method protocols. Acceptance criteria and corrective action procedures for out-of-control surrogate spike results are listed in the laboratory QAPPs.

7.5.2.3 Internal Standards

Internal Standards are compounds of known concentrations that are added in a constant amount to samples, blanks, and calibration standards and are used to correct for the loss of analyte during sample preparation. The internal standard is a compound that is very similar, but not identical to the chemical species of interest in the samples, as the effects of sample preparation should, relative to the amount of each species, be the same for the signal from the internal standard as for the signal(s) from the species of interest in the ideal case. Acceptance criteria and corrective action procedures for out-of-control internal standard spike results are listed in the laboratory QAPPs.

7.6 Element B6 – Instrument/Equipment Testing, Inspection and Maintenance

This section describes the instrument testing, inspection and maintenance procedures.

7.6.1 Field Instruments

All measuring equipment must be calibrated and maintained on a periodic basis dependent on the manufacturer's maintenance schedule. The purpose of preventative maintenance is to address potential problems before they occur and to verify that equipment/measurement systems operate adequately when used to collect environmental data. Specific preventative maintenance procedures to be followed for the field equipment are those recommended by the manufacturer and those described in the applicable SOPs. Documentation of equipment maintenance shall be maintained by the field notebook.

Proper equipment cleaning and field decontamination procedures are necessary to prevent cross contamination of samples. Sampling equipment will be decontaminated prior to the start of activities and between sampling locations. Decontamination of equipment may involve the use of a laboratory grade, phosphate-free detergent such as Alconox or Liquinox. Equipment will be rinsed with tap water obtained from a local municipal supply or commercial source. Distilled, de-ionized water will be used as the final water rinse.

Field personnel performing the sample collection activities and handling of equipment will don a new pair of nitrile gloves prior to use of the equipment, between sampling and between decontamination procedures.

A summary of the maintenance requirements for field equipment used at the Site is provided in Table 6.

7.6.2 Laboratory Instruments

As part of their QA/QC program, the laboratory will conduct a routine preventative maintenance program in an effort to minimize the potential occurrence of instrument failure and other system malfunctions. These procedures will be documented by the laboratory and will be verified through laboratory audits conducted by the laboratory QA/QC Officer.

Appropriate documentation of all equipment/instrument maintenance shall be maintained by the laboratory personnel and shall include what was done, date, time (if appropriate), next scheduled maintenance, equipment status, anomalies, and personnel performing maintenance. This documentation shall be entered into specific maintenance log forms for laboratory maintenance activities as described in the laboratory QAPPs and SOPs.

7.7 Element B7 – Instrument/Equipment Calibration and Frequency

This section describes the instrument calibration procedures.

7.7.1 Field Instruments

Field instruments and equipment will be calibrated in such a manner that accuracy and reproducibility of results are consistent with the manufacturer's specifications. Calibration of field instruments will be performed at the intervals specified by the manufacturer, or more frequently as conditions dictate. In the event that an internally calibrated field instrument fails to meet calibration/checkout procedures, it will be removed from service until the problem is resolved. Any field equipment that fails to calibrate should be documented in the field notebook, including the date and reason for calibration failure. Additionally, when the field equipment problem is resolved it should also be documented in the field notebook.

Field instruments that are rented from third-party rental services should be calibrated prior to being delivered to the Site. Documentation of calibration should be provided by the rental service or onsite calibration will need to be performed. A summary of the calibration requirements for equipment used at the Site is provided in Table 6.

7.7.2 Laboratory Instruments

Calibration of laboratory equipment for analyses will be based upon approved written procedures in accordance with the requirements of the various analytical methods. Specific instrument calibration information should be provided in each laboratory QAPP.

Analytical instruments will be calibrated in accordance with the referenced analytical methods. Calibration standards are prepared in the laboratory by dissolving or mixing a known amount of nominally pure analyte in the appropriate matrix using volumetric containers. Calibration standards must be prepared from a standard source that is traceable to a certified primary reference material. All calibration standards must be prepared so that the types and concentration of the reagents used in the standard preparation are equivalent to the types and concentration of the reagents used in preparing the samples to be analyzed. Records of standard preparation and instrument calibration will be maintained by the laboratory.

Initial calibration and continuing calibration verification checks will be performed in an effort to determine that the instrument is capable of producing acceptable qualitative and quantitative data for the particular method being analyzed. Initial calibration is performed to demonstrate acceptable performance at the beginning of the analytical run and to verify the linearity of the instrument response within a specific concentration range. The continuing calibration is performed to ensure that the initial calibration is still valid for the instrument. Calibration protocols, including calibration frequencies, conditions, and acceptance criteria, are described in the laboratory QAPP.

7.8 Element B8 – Inspection/Acceptance of Supplies and Consumables

Certain supplies and consumables associated with the field sampling program are considered "critical", (i.e., which may directly or indirectly affect the quality of the results). These include sample containers, tubing, and filters. The RI Field Manager will be responsible for ensuring that an adequate supply of the critical supplies and consumables is available and that consumables are certified clean. The employees conducting the field activities will be responsible for receiving all supplies / consumables and verifying that all materials are stored in a safe location until being used. The employees conducting the field work should communicate with the RI Manager if supplies need to be replaced or additional supplies need to be procured.

Sample containers will be provided by the laboratory, pre-cleaned and with appropriate preservative added. The laboratory has a control procedure in place to ensure cleanliness of sample containers, as described in its QAPP. In addition, there are other laboratory-related critical consumables such as reagent water and reference standards. The adequacy of these materials will be ensured and documented in accordance with the laboratory's QAPP.

7.9 Element B9 – Non-Direct Measurements

This element is intended to address data obtained from existing sources rather than directly measured or generated during the RI/FS.

During the RI/FS, discharge of the Flathead River will be automatically measured at the closest USGS gauging station, which is located approximately three miles southwest of the Site near Columbia Falls (USGS Station #12363000). The USGS data will be used in conjunction with data collected from a temporary staff gauge that will be installed within the Flathead River to develop a relationship of the Flathead River discharge immediately adjacent to the Site. River levels measured at the staff gauge will be used in conjunction with measured groundwater elevations to evaluate groundwater / surface water interactions.

Also during the RI/FS, meteorological data may be used to evaluate the potential impacts of precipitation events. Meteorological data will be downloaded from the National Oceanic & Atmospheric Administration (NOAA) website for the weather station located at Kalispell Glacier Park International Airport, located in Kalispell, Montana (Station ID# 244560).

No additional outside data sources are expected to be used during the RI/FS.

7.10 Element B10 – Data Management

The RI/FS will generate an extensive amount of information that needs to be properly documented and managed in order to support risk assessment, remedy selection decisions and any legal or cost recovery actions. Therefore, data management procedures will be followed to ensure the quality, validity and security of the RI/FS data.

Roux Associates is the custodian of the project files and will maintain all relevant records, reports, logs, field notebooks, pictures, and subcontractor reports in a secured area and under custody of the RI Project Manager. Access will be restricted to project personnel, and the ability to view and/or add or change data will be granted to only those individuals identified and trained to perform those tasks. To the extent practical, data will be obtained and archived electronically. When electronic data collection is not practical, data will be archived in the project files. The non-electronic data (and reports that are evaluated including reports received for the Historical Data Review) will also be scanned for electronic archiving.

A variety of data will be generated during the RI/FS field program, including photos, manual field measurements, data collected and logged automatically by field instruments, and results of chemical analyses. Management of these data will vary from type to type, as discussed below.

Photo Documentation

Field personnel are encouraged to use digital photography to document Site features or field activities. Photos will be collected and stored within the project file in accordance with Roux SOP 6.5.

Manual Field Measurements

Manual field measurements will be recorded in field logbooks or activity-specific field datasheets. Entries in the field logbooks will be photocopied as soon as practicable following each Site visits to ensure that a backup copy of the field measurements exists in the event the field logbook is lost, stolen, or destroyed. Photocopies of field logbooks will be kept in the project file. Field datasheets will also be returned to the office as soon as practicable following each site visit. Field datasheets will be digitized and kept in the project file. Field datasheets are described in Section 6.7.2 and example datasheets are attached to this QAPP in Appendix B.

Laboratory Results

The analytical laboratory will provide a summary report, electronic data deliverables (EDDs), and a CLP-Level IV equivalent data package. The Level IV data package will contain data to perform a data validation to evaluate whether the data meets the performance and acceptance criteria as described in Section 6.5.

Level IV data packages will include the following:

- sample results
- forms and checklists summarizing all QC measurement parameters specified in the method
- all associated raw data generated in support of the reported results

Forms summarizing all QC measurement parameters specified in the method include:

- instrument tuning summary and associated sample summary

- initial and continuing calibration data summaries
- internal standard response and retention time summaries
- laboratory control sample (LCS) data summaries
- MS results
- surrogate standard results
- laboratory duplicate summaries

Raw data will include copies of all associated instrument printouts and laboratory notebook records that were generated during sample preparation and analysis.

Laboratory EDDs delivered to Roux Associates will be uploaded into Roux Associates' EQuIS™ project database described below.

Project Database

A database will be created to organize, analyze, and store project information and data. EQuIS™, a relational database system based on Microsoft Access, is the system currently planned for use at the Site. EQuIS™, or an alternative system will similar capabilities, will be used to:

- Provide a single centralized repository for field measurement data and laboratory analytical results (soil, soil gas, groundwater, surface water, sediment and ~~sediment porewater~~).
- Provide a user-friendly interface for database queries and generation of data summary tables.
- Allow the data to be viewed and displayed in a GIS compatible format, along with other GIS data layers.
- Provide detailed information about sampling locations, sample types, sampling and analytical methods, results, and QA information.
- Provide simple comparisons to regulatory standards or risk-based screening levels, along with calculations of descriptive statistics.
- Generate export files to spreadsheets, data analysis software, or other databases according to their requirements.

Laboratory analytical data will be added to the database using standardized formats and a QA program. The QA program checks the format and completeness of chemical data. Most data will be transferred directly from the laboratories via electronic files to eliminate the potential for error during keyboard data entry.

All data that is manual input into the database will be printed, 100% verified against the original source documents, and corrected if necessary within the EQuIS system. The hard copies will be initialed as they are checked during verification of electronic versions of the original source documents.

All validated results of sampling and tests and all other validated data received by CFAC will be made available to the EPA via web access. Access credentials to the web access will be provided following setup of the project database. The validated data will also be provided in progress reports noted in Table 10 of the RI/FS Work Plan. The RI/FS Manager has overall responsibility for the project database. The RI Manager will be responsible for ensuring that the project database is updated during the Phase I Site Characterization.

Roux Associates IT department will provide backup of the electronic database daily. Additionally, the need for any upgrades to the hardware or software required to manage the RI/FS data will be determined jointly by Roux Associates IT department and the RI/FS Manager. Any upgrades needed will be completed as necessary to facilitate the project.

8.0 GROUP C – ASSESSMENT AND OVERSIGHT

The two elements in this group detail the assessments and evaluations that will occur during implementation of the RI/FS to determine whether this QAPP is being implemented as approved, to increase confidence in the information obtained, and ultimately to determine whether the information may be used for its intended purpose.

8.1 Element C1 – Assessments and Response Actions

Five internal field audits will be conducted by the QA Officer or his/her designee during the Phase I Site Characterization Program. The major sampling activities to be audited include soil gas screening/passive soil gas sampling, soil sampling, sediment sampling, groundwater gauging and sampling, and surface water sampling. The audits will focus mainly on measurement and sampling procedures, to ensure that representative data are being generated in the field. The audits will be timed to occur early implementation phase of each activity to allow for timely corrective action, if needed, prior to the generation of a significant amount of data. The field audits will ensure that data being collected during the RI meets the DQOs for the RI. All field audits should be provided to the RI/FS Manager and RI Manager via email for filing in the project records.

If any deviations are noted during the field audit, the QA Officer has full authority to stop work and discuss the deviation with the field personnel. The QA Officer will develop a corrective action plan that will be communicated with the field personnel and the RI/FS Manager, with clear consensus regarding the individual responsible to complete the action. The QA Officer should define a timely schedule and should verify all corrective actions are completed and documented in the project file. Laboratory calibration and checks are discussed in Section 7.5.2. Laboratory corrective actions generally address the need to bring data generating systems back into conformance after some trigger or other criteria have shown the system to be out of conformance. Generally, laboratory functional problems may occur during sample handling, sample preparation, laboratory analysis, and data review. The need for laboratory analysis corrective actions is based upon predetermined limits for accuracy, precision, and completeness. By conducting system and performance audits, the Laboratory QA Officer will determine if the data are acceptable and if corrective actions are necessary. The analytical laboratory will perform internal audits and corrective actions in accordance with its QAPP.

8.2 Element C2 – Reports To Management

As described above, at least five field QA audits are scheduled in addition to any laboratory audits that may be conducted. The field QA reports will be prepared by the QA Manager and submitted to the RI/FS Manager and RI Manager for storage in the project files. In addition, the QA Manager may prepare correspondence and submit to the RI/FS Manager, if needed, to document any corrective actions that may be required.

9.0 GROUP D – DATA VALIDATION AND USABILITY

The three elements in this group address the final project checks to determine whether the data developed conform to the stated objectives of the project and to estimate the effect of any deviations.

9.1 Element D1 – Data Review, Verification, and Validation

This element identifies the criteria for deciding to accept, reject, or qualify project information. Such decisions will be based on the data review, verification, and validation procedures described below in Section 9.2, which will determine whether the data meet the project DQOs.

Analytical data will need to achieve specific criteria in order to minimize the possibility of either making erroneous conclusions or failing to keep uncertainty in estimates to within acceptable levels.

Performance and acceptance criteria, together with the appropriate level of QA practices, will guide the evaluation of existing data relative to the intended use. Section 6.5 of this QAPP provides specific details regarding the precision and accuracy control limits, and MDLs/ PQLs, for each of the target analytes and matrices, and the overall project goals for completeness and representativeness. Data which do not meet one or more performance criteria may still be acceptable for project use, although some degree of qualification may be required. Data grossly failing to meet one or more performance criteria will be rejected, unless substantial other evidence supports use with qualification.

Use of statistical intervals to evaluate decision errors will not be performed as part of the investigation because sampling will be primarily focused on determining conditions around Site features and potential source areas. Measurement error will be the primary factor affecting any decision. Error encountered as a result of sampling procedures will be limited to the extent practicable by following approved EPA methods and applicable standard operating practices.

9.2 Element D2 – Verification and Validation Methods

Field data validation will initially be performed by the field personnel while collecting data/samples. QA/QC of the field data is the responsibility of the RI Manager. Field data validation includes ensuring that data was properly collected and handled according to the sampling procedures described in this SAP and the SOPs. Decisions to repeat data collection and/or void data may be made by the RI Manager, if necessary, based upon the extent of the deficiencies and their importance in the overall context of the RI. The RI Manager may discuss the results of the field data verification and validation with the RI/FS Manager. The RI/FS Manager will ultimately decide if the data is unusable or if additional validation steps may be required. If data is deemed unusable, either the RI Manager or the RI/FS Manager will discuss with the project staff.

Validation of laboratory data will be performed in accordance with the following USEPA guidance:

- *National Functional Guidelines for Organic Data Review* (USEPA, 2014a);
- *National Functional Guidelines for Inorganic Data Review* (USEPA, 2014b); and
- *Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use* (USEPA, 2009).

All laboratory data packages will be verified and validated using a Stage 4 validation to evaluate whether the data meets the performance and acceptance criteria. The Stage 4 validation will be performed on 100% of the laboratory data generated during the RI/FS to support risk assessment and remedy selection. As described in the guidance (USEPA, 2009), the Stage 4 verification and validation will include completeness and compliance checks of sample receipt conditions, both sample-related and instrument-related QC results, recalculation checks, and the review of actual instrument outputs.

All data packages will be reviewed by a qualified, third-party data validator. The data validator will document findings by adding appropriate validation qualifiers (as necessary) to the sample results in the laboratory data packages based on the various verification and validation tasks. The following qualifiers will be applied to the data to identify data limitations identified during validation:

U .... The analyte was analyzed for, but was not detected above the level of the reported sample quantitation limit.

UJ .... The analyte was analyzed for, but was not detected. The reported quantitation limit is approximate and may be inaccurate or imprecise.

J .... The result is an estimated quantity. The associated numerical value is the approximate concentration of the analyte in the sample.

J+ .... The result is an estimated quantity, but the result may be biased high.

J- .... The result is an estimated quantity, but the result may be biased low.

R .... The data are unusable. The sample results are rejected due to serious deficiencies in meeting Quality Control (QC) criteria. The analyte may or may not be present in the sample.

A summary of the data verification and validation processes will be included in a Data Summary Usability Report (DUSR). The verified and validated analytical data will be included in the RI Phase I data summary report. The QA Officer is responsible for communicating with the data validator to ensure the data is validated. It is the ultimate responsibility of the RI/FS Manager to ensure that the entirety of the laboratory data collected during the RI/FS is validated.

9.3 Element D3 – Reconciliation With User Requirements

Once all samples have been collected and analytical data has been generated, data will be evaluated to determine if DQOs were achieved. Only data generated in association with QC results meeting the stated acceptance criteria (i.e., data determined to be valid) will be considered usable for decision making purposes. Rejected data will be clearly indicated during validation and made unavailable for use. The Phase I data summary report will include a qualitative and quantitative review of all QC samples and all deviations from the SAP described in this report, along with conclusions regarding the reliability of the data for their intended use.

Respectfully submitted,

ROUX ASSOCIATES, INC.

Michael Ritorto
Senior Hydrogeologist

Andrew Baris
Principal Hydrogeologist/
Vice President

10.0 REFERENCES

Amplified Geochemical Imaging, LLC, 2015. Soil Gas and Subslab Soil Gas Description of Services.

CFAC, 2013. CFAC PowerPoint Presentation for EPA. June 3, 2013.

Hydrometrics, 1993. Assessment of Hydrologic Conditions Associated with the Closed Landfill and Calcium Fluoride Pond North of the Columbia Falls Aluminum Company Plant and Plant Water Well Number 5, March 1993.

Hydrometrics, 2013. Background Concentrations Of Inorganic Constituents In Montana Surface Soils, September 2013.

Interstate Technology & Regulatory Council, 2012. Incremental Sampling Methodology, February 2012.

U.S. Environmental Protection Agency (EPA), 1988. USEPA Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, October 1988.

U.S. Environmental Protection Agency (EPA), 1996. USEPA Soil Screening Guidance Users Guide, Second Edition, July 1996.

U.S. Environmental Protection Agency (USEPA), 1998. AP 42, Fifth Edition, Volume I, Chapter 12: Metallurgical Industry, Section 12.1 Primary Aluminum Production. October, 1998.

U.S. Environmental Protection Agency (USEPA), 2002a. Guidance for Quality Assurance Project Plans. December, 2002.

U.S. Environmental Protection Agency (USEPA), 2002b. Guidance for Choosing a Sampling Design for Environmental Data Collection, EPA QA/G5-S, December 2002.

U.S. Environmental Protection Agency (USEPA), 2006. Guidance on Systematic Planning Using the Data Quality Objectives Process, February 2006.

U.S. Environmental Protection Agency (USEPA), 2009. EPA Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use, January 2009.

U.S. Environmental Protection Agency (USEPA), 2010. Ground Water Sampling Procedure, Low Stress (Low Flow) Purging and Sampling Procedure for the Collection of Groundwater Samples From Monitoring Wells. January 2010

U.S. Environmental Protection Agency (USEPA), 2014. Superfund Chemical Data Matrix (SCDM) database. Superfund, National Priorities List, HRS Toolbox. January 30, 2014.

U.S. Environmental Protection Agency (USEPA), 2014. National Functional Guidelines for Organic Data Review. August, 2014.

U.S. Environmental Protection Agency (USEPA), 2014. National Functional Guidelines for Inorganic Data Review. August 2014.

U.S. Environmental Protection Agency (USEPA), 2015. Regional Screening Levels for Chemical Contaminants at Superfund Sites. January 2015

Weston Solutions, 2014. Site Reassessment For Columbia Falls Aluminum Company Aluminum Smelter Facility Columbia Falls, Flathead County, Montana. April 2014.